Telephone Engineer

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The Drift of Business Opportunity

Only a few years ago the promotion of wild-cat business ventures attracted the attention and interest of large financiers over this country. Wealthy men found their wealth increasing by leaps and bounds. It seemed they could do no wrong. They bought stock. And regardless of the nature or soundness of that stock, over night they would find their millions doubled, tripled, and quadrupled. It became a game. How many millions could be made in a week or day by "clever" investing? Men talked it over in clubs, in drawing-rooms, and on the golf course.

So much time did they spend in chatting of their easy millions, that many of the country's wealthy men neglected the legitimate, regular channels of industry. All went well for a time, and then "the bottom fell out." Financial balloons exploded. Promotion schemes collapsed. And legitimate business hit the down grade in sympathy with the descension of "high finance." Normally sound industry was caught in the landslide.

There can be no adequate solution to the problem of who or what caused the depression. It is reasonable to suppose that there is as much money in our country now as there was before the halt in prosperity. None of it has been burned, but much has been withdrawn from circulation by timid persons. Naturally, when the public stops buying, business stops prospering.

The telephone industry has not escaped the effect of "the sins of the wicked" and the fear of the timid and irresolute. In many places subscriber patronage has shrunk and toll revenues are not normal. On the other hand, there has been sufficient income to keep heads above water and wages and other obligations have not been seriously retarded. Indeed the telephone business has stood bravely and most successfully in the face of unfavorable conditions.

What of the future? It will be mostly what we make it. Our intentions will be reflected by our subscribers and our business. Prosperity will not return in a day but if business will readjust itself to the conditions now prevailing it will have made a start toward the return of trade and commerce activity. We must all give and take in order to achieve concerted action toward the goal of prosperity. Nothing can be gained if only one industry or one individual business shall attempt to bear the burden of reconstruction. All must hang the I WILL sign on the outer walls.

To wait for others to do it or for legislation to dig us out of our own fiscal folly is just so much time lost. Business will eventually return to normalcy and the sooner we all quit waiting and doubting, the better it will be for our business and our country.

Doing the Odd Jobs To-Day

There is at least one telephone man who is not discouraged by the present business outlook but rather who welcomes the present period of more leisurely business activity. Recently, he told us, that for the first time in several years, it had been possible to take time to clear up an accumulation of minor jobs. None of them were of much importance in themselves yet in some way or another they interfered with the operation of the plant at maximum efficiency.

As an illustration, he referred to a certain toll circuit which had been giving a good grade of commercial service over a long period of years. It had never been the source of transmission or other service complaint. Yet it was not the best possible circuit because the plant people knew that the slight inductive noise and cross talk to which it was subject could be reduced. A careful check of transpositions and a balancing of the circuit did reduce the noise and cross talk and what was formerly considered to be a fairly good circuit is now a first class circuit.

Among the other jobs were included minor relocations of pole lines to avoid trees or other hazards, inspection of drop wires and rerouting of drops to avoid trees, and inspection of cables for missing rings, contacts with trees, poles and building. Literally hundreds of potential cases of trouble have thus been avoided and many minor improvements in service have been made.

Many of these jobs could have been deferred but by doing them now the regular forces of the company have been given continuous employment, and when the turn in business comes requiring that the efforts of the company be turned to the provision of additional facilities, these jobs will not impede work that must be done to take care of new business.

Advantages of Good Equipment

At telephone conventions and conferences, we hear men who have been successful in the business over a period of years urging the importance of taking care of each detail properly, accurately, and thoroughly. They say if a thing is to be done at all, it must be done well.

This advice is corroborated by men in all industrial pursuits who have the conviction of experience and a vision for future success as their guide. They base their proposition on the theory that the makeshift is unsatisfactory and uneconomical in the long run, and often is the forerunner of disappointment and failure.

In the early days of the Independent telephone business, groups of inexperienced men put their money into the telephone without sufficient assurance of patronage to warrant substantial equipment. Hence they built cheaply, using cheap poles, cheap wire, cheap exchange outfits, and cheap everything. With such equipment first class service, if possible at all, was of short duration, plant depreciation was rapid, and upkeep was too expensive to allow for profit.

But today the telephone industry is on a different plane. The telephone has grown to be an important factor in daily civilized life. The telephone is here to stay, to improve, and to gain constantly increasing importance. Therefore today we are in a position to judge the investment we can make which will yield a living profit. And over and above all, today we know that good service and satisfactory returns cannot result from inferior equipment, and that the use of cheap equipment is the worst sort of extravagance.

The trouble and expense of the upkeep of a telephone plant decreases in direct proportion as the quality of the original equipment is increased. Smoothly operated telephone lines give more satisfaction and help create that intangible but necessary commodity—the good-will of our subscribers. Thus good equipment naturally brings about more subscribers and more money in our cash registers.

Elementary Course in Telephone Practice

The Application of Ohms Law to Series Circuits from the Point of View of Amperes, Volts, and Ohms, and Also to Parallel and Combination Circuits, Is Explained in This Third Chapter of a Study of the Telephone by O. B. Fensholt, Which Provides a Reliable Background for Beginners

Electrical Circuits

We now understand the three rules of Ohms Law, which are:

$$\left.\begin{aligned} A &= \frac{V}{O} \\ V &= O \times A \\ O &= \frac{V}{A} \end{aligned}\right\} \text{or} = \frac{V}{O \times A}$$

So far we have only considered Ohms law as applied to an individual electrical object; that is, should we wish to know the resistance of a certain coil, we know that if we have the voltage and the amperes given, we can calculate the ohms.

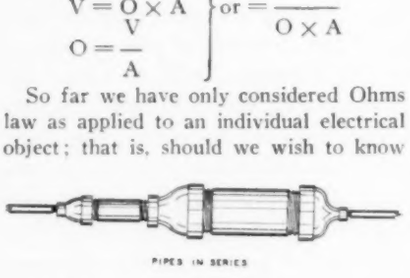


Fig. 1

Since our electrical problems deal with any number of electrical objects in a circuit, instead of one individual object, it will become necessary to know how to apply Ohms law to these circuits.

These objects or pieces of electrical apparatus usually are connected in one of two ways; series or parallel.

Series: When we say things are in series, we mean they are connected in rotation, or one after the other. Then in our electrical problems, when electrical apparatus is connected in this manner we call it a series circuit. Figure 1 shows pipes and electrical apparatus connected in series.

Parallel: In railroading of single track type it is necessary to have a "siding" for trains to pass one another. This "siding" is made with a switch at one end leading from the main line for trains to leave the main line, and another switch at the other end of the "siding" to the main line for the trains to return to the main line. This "siding" is known as a "shunt," because it shunts or takes some of the cars (or traffic current) off the main line. We might say this shunt is parallel to the main line or a multiple of the main line. Now in our electrical problems, where any electrical objects are connected side by side, and the current is divided, we call them "parallel" circuits. Other terms are also known as "shunt" or "multiple," the same as in railroading.

Figure 2 shows pipes and electrical apparatus connected in parallel.

We will have electrical problems which may have both series and parallel circuits, or problems dealing with both circuits at once, known as combination circuits.

Figure 3 shows a combination electrical circuit.

Therefore we will have problems that deal with these three kinds of circuits, namely:

1. Series circuits.
2. Parallel circuits.
3. Combination circuits.

The methods of finding the total amperes, volts or ohms of these circuits

differ, so we must study problems dealing with the various circuits.

Series Circuits—Current (Amperes)

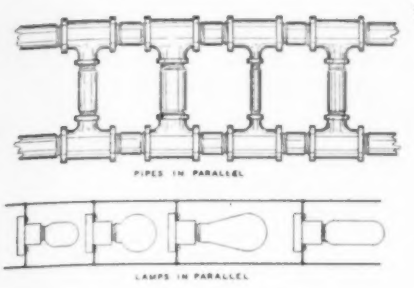


Fig. 2

If we connect several pipes of various diameters together and let a current of water flow through the pipes, the water cannot go into the first pipe any faster than it goes out of the last pipe. In other words, there must be the same number of gallons per second flowing in each pipe.

In Figure 4 we have four pipes connected in series and a current of water is flowing which keeps each pipe filled.

If water is flowing out of pipe No. 4 at the rate of five gallons per second, it must flow out of pipe No. 3 at the same rate in order to keep pipe No. 4 filled. This is true for each pipe in order. Then you can see that the curent must be the same in any part of a series circuit.

In this same manner we can connect several pieces of electrical apparatus of various resistances (ohms) and force a certain amount of current (coulombs per second, or amperes) through these resistances. The current (amperes) cannot go

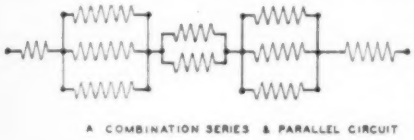


Fig. 3

through the first resistance any faster than it goes out of the last resistance.

Let figure No. 5 represent a series circuit of electrical apparatus, consisting of a coil of 10 ohms (C), a buzzer of 40 ohms (B), a lamp of 50 ohms (L), and a relay of 20 ohms (R).

If the current (coulombs per second) flows out of the relay at the rate of 5 amperes, it must flow out of the lamp at the same rate in order to keep the relay filled. This also must happen with the buzzer and the resistance coil. Therefore the current must flow in at the coil at the same rate as at the relay. Or we may say that the amperes are the same in every part of a series circuit, regardless of what the resistances may be.

If we are able to find the amperes of any one part of a series circuit, we know the amperes in all the other parts.

Series Circuits—Resistance (Ohms)

We have already set up our standard of the fact that it takes one volt pressure to force one ampere of current, through one ohm resistance, and we said that a No. 10 copper wire, 1,000 feet long, was used as a standard of one ohm.

If we then had two wires of this standard, connected in series, or 2,000 feet, it would take twice as much current to get through all this wire, or you will notice that the resistance is twice as great, or two ohms resistance.

On the other hand, if we should cut our standard wire in half, or to equal 500 feet, you can see that we have cut our resistance in half or to one-half ohm.

We then can change the resistances of our series circuits by changing the length or we might say by adding or taking away from the circuit. That is, each time you add to your series circuit your total resistance is greater, or the total resistance of a series circuit would be equal to the sum of each separate resistance in that circuit.

The total resistance of Figure 5 would therefore be 10 ohms, plus 40 ohms, plus 150 ohms, and plus 20 ohms, or a total of 220 ohms.

Our rule for the resistance of a series circuit would then be:

"In a series circuit the combined resistance of pieces in series is equal to

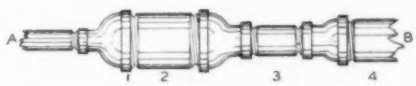


Fig. 4

the sum of each separate resistance."

Then if we know the ohms of each separate resistance of a series circuit, we can add them together and it will give us the ohms of the entire circuit.

Series Circuits—Pressure (Volts)

If we take a tank of water 10 feet high it would have a pressure of about 4.5 pounds per square inch, and if we should double the height of the tank we would double the pressure to 9 pounds per square inch.

Let us take four tanks of various sizes, as shown by letters A, B, C and D of Figure 6, and let A be 15 feet high, B, 20 feet high, C, 5 feet high, and D, 10 feet high.

The pressure would then be 6.75 pounds per square inch in A, 9 pounds per square inch in B, 2.25 pounds per square inch in C, and 4.5 pounds per square inch in D.

If we now connect these tanks together, one on top of each other, we would have the equivalent to a 50-foot tank, or the same as five 10-foot tanks, and we said each 10 feet would equal 4.5 pounds per square inch, so the total pressure would be five times 4.5 or 22.5 pounds per square inch for all tanks.

Also notice that you have a sum of A + B + C + D tanks, or 6.75 + 9.0 + 2.25 + 4.5 pounds per square inch, or a total of 22.5 pounds per square inch.

You will then notice that the total pressure of these pipes in series equals the sum of the pressure of each separate part.

Referring back to Figure 5, we will assume that there are two amperes of current flowing through the 10 ohms coil. Then from our previous information regarding current in series circuits, we know that the amperes remain the same through the entire circuit, or that there

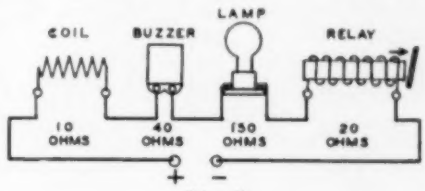


Fig. 5

must be two amperes flowing through each resistance.

Now by applying Ohms Law (V = O × A) we find that the coil requires 10 ohms × 2 amperes = 20 volts. Also the buzzer requires 40 ohms × 2 amperes = 80 volts, the lamp requires 150 ohms × 2 amperes = 300 volts, and the relay requires 20 ohms × 2 amperes or 40 volts. Therefore it will require a total of 20 + 80 + 300 + 40, or 440 volts to force 2 amperes through these resistances. You will note then that the voltage of a series circuit is equal to the sum of all the voltages.

Let us set a rule like this:

"In a series circuit the total voltage is equal to the sum of the volts across each separate resistance."

Let us use another method to find the total volts to prove that our voltage is 440 volts. We said previously that the ohms of a series circuit is equal to the sum of each separate branch. Then the resistance for the entire circuit equals

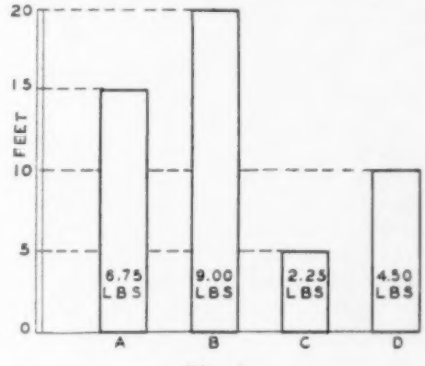


Fig. 6

10 + 40 + 150 + 20, or 220 ohms. We also know that the current of a series circuit remains the same. Then if we know that there are 2 amperes in the coil, there must be 2 amperes in the whole circuit. By Ohms law (V = O × A) we will multiply 220 ohms, the total resistance of the circuit, by 2 amperes, the total current of the circuit, and we again get 440 volts, the total pressure of the circuit.

Our Engineering and Management Course

Common Battery Subset Theory and Circuits Are Explained in This Article, the Fifth Chapter of the Course of Practical Technical Instruction Prepared by B. C. Burden, Transmission Engineer, Lincoln Telephone and Telegraph Company, for TELEPHONE ENGINEER

General

The four previous articles of this series discussed the theory and circuit arrangement of magneto subsets, switchboards, and central offices.

This article discusses common battery subset theory and circuits.

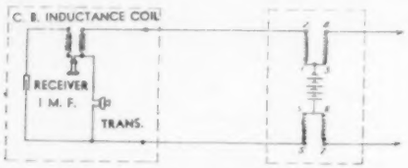


Fig. 1—Booster type common battery talking circuit.

The basic difference between local and common battery plants is the fact that local battery telephones derive their transmitter current from dry cells located at each telephone, whereas common battery telephones obtain their current from a storage battery located at the central office and common to all telephones.

Common battery telephone systems also utilize the direct current which flows from the central office to subscribers' sets for supervision and signaling purposes, whereas magneto systems must depend on a small magneto located in each telephone for supervision and signaling.

The principal advantages of common battery telephones as compared to magneto telephones are:

1. More uniform transmission.
2. Lower station maintenance costs.
3. Positive supervision.
4. Better appearing subsets.

The transmission efficiency of a local battery telephone is at a maximum when the dry cells are new and diminishes with the age and use of the dry cells. The transmission efficiency of a common battery telephone is always uniform, as the central office battery voltage does not vary except over a very small range during the period the battery is being charged.

Magneto telephones must be visited at least once each year for battery replacement and the cost of the batteries plus the labor makes magneto stations more expensive to maintain than common battery.

Incoming signals and cord circuit supervision are more positive and satisfactory on common battery than magneto plants, as these functions are accomplished without any effort on the subscribers' part except removing and replacing the receiver on the hook.

Common battery subsets can be made in small compact cases as they do not require batteries or a magneto. The magneto plant has one advantage over the common battery plant, viz., circuit faults such as leaks or grounds are less liable to cause a complete interruption of service than is the case with common battery plants.

Theory of the C. B. Booster Type Circuit

There are a number of different types of C. B. subset circuits in use. However, the latest and most efficient is the "booster circuit," shown in Fig. 1. It will be noted that this circuit consists of an induction coil, receiver, transmitter, and condenser.

The ringer is omitted from the circuit shown in Figure 1 so that the transmission features of the booster talking circuit may be more easily understood.

The theory of this circuit is as follows: Current from the central office battery flows through the winding of the battery feed coil out over the line to the subscriber's set through winding one-half of the sub-set induction coil, through the transmitter and back to the central office battery.

Current does not flow through the receiver because of blocking action of the condenser to direct current. When the subset transmitter is spoken into, the resulting variation in resistance of the transmitter causes the normally steady direct current flowing from the central office battery to fluctuate in synchronism with the impressed voice. This fluctuating direct current sets up an alternating voltage across the 3-4, 7-8 winding of the battery feed coil. This induced voltage sets up a current which passes on to the listening subscriber.

In addition to this action, a secondary effect takes place which greatly increases the transmission efficiency of this circuit. This secondary or "boosting" effect results from the increasing and decreasing direct current which flows through the transmitter and winding 1-2 of the induction coil causing the condenser to alternately charge and discharge in the closed circuit consisting of condenser, receiver and winding 3-4 of the induction coil.

This charging and discharging action of the condenser sets up an alternating current across winding 1-2. The windings are so connected that this current adds to the fluctuating direct current due to the direct action of the transmitter. The normal current variation is thus greatly "boosted" by this secondary action.

All present day common battery telephones are of the "booster type," but prior to the expiration of the patents covering the booster circuit many other types of common battery circuits were used and thousands of C. B. phones now in use have inefficient transmitting circuits, as compared to the booster circuit.

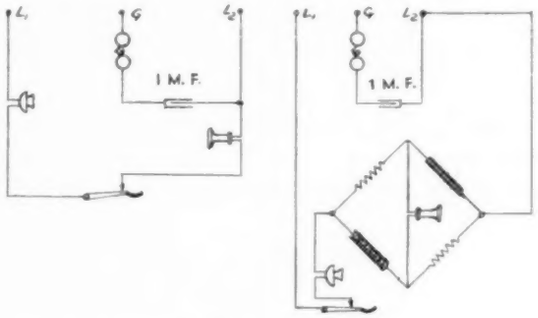


Fig. 2—Series type C. B. circuit.

Fig. 3—Wheatstone bridge C. B. circuit.

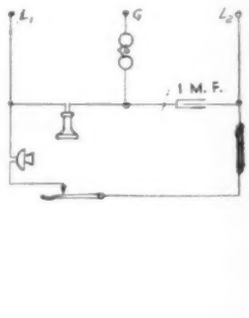


Fig. 4—Impedance coil condenser C. B. circuit.

The following paragraphs explain the principle of C. B. circuits other than the booster circuit. Many companies have converted inefficient sets to the booster type circuit by replacing a few sets at a time and rebuilding the removed sets in the shop.

Series Type C. B. Circuit

One of the simplest C. B. telephone circuits is that known as the "series circuit."

This circuit is shown in figure 2. It consists essentially of a direct current receiver in series with a transmitter.

The direct current receiver unlike the typical polarized receiver does not use a permanent magnet but utilizes an electro-

magnet which is magnetized by the transmitter current which flows through it.

The receiver winding is of fairly low resistance, and therefore does not materially reduce the direct current flowing to the transmitter.

It is necessary to use a direct current receiver with the series circuit, as direct current flowing through an ordinary receiver may interfere with its proper operation, by either freezing the diaphragm to the pole pieces, or neutralizing the field due to the premanent magnet.

The series circuit is still used in some cases for intercommunicating system subsets, and other cases where transmission efficiency is not important. In general the direct current type of receiver has a lower receiving efficiency than the regular polarized receiver, and the series circuit may be considered the poorest of the non-booster type C. B. subset circuits from a transmission standpoint.

The advantage of the series circuit is its simplicity and reduced costs.

Wheatstone Bridge C. B. Subset Circuit

Another early day C. B. circuit was the Wheatstone Bridge arrangement as shown in figure 3.

In this circuit direct current is kept out of the receiver by placing it at the mid point of a balanced Wheatstone Bridge circuit. Two of the bridge arms contain non-inductive resistors, while the other two contain inductance coils. All of the coils have the same ohmic resistance.

In operation the direct current flows to the arms of the bridge in parallel and the bridge being balanced to direct currents no direct current flows through the receiver, because of the reaction of the inductance coils; however, the bridge is unbalanced to voice currents and receives these with but little loss.

The inductance coils are designed to offer a high impedance to 1000 cycle currents. This circuit arrangement while functioning satisfactorily according to its theory, has a low transmission efficiency as compared to the booster circuit and is no longer used.

Impedance Coil-Condenser Circuit

The impedance coil-condenser C. B. circuit consists of an inductance coil and condenser connected as shown in figure 4. The condenser serves to keep direct current out of the receiver though permitting voice frequency currents to pass through with a minimum of loss.

The inductance coil offers a high impendance to voice frequency currents but being of low ohmic resistance permits direct current to flow through the transmitter.

A large number of these sets are in use although they are not nearly as efficient as the booster circuit.

Induction Coil C. B. Circuit

One other type of C. B. circuit which was used prior to the expiration of the booster circuit patents was one which used an induction coil to prevent direct current from flowing through the receiver. This circuit is shown in figure 5. It will be noted that direct current can flow through the transmitter and primary of the induction coil, but only voice frequency currents in the secondary winding and receiver circuit.

The induction coil serves merely to keep direct current from flowing through the receiver.

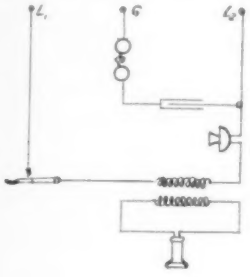


Fig. 5—Induction coil common battery.

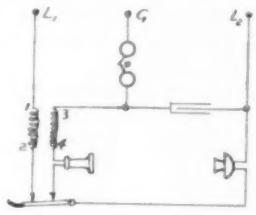


Fig. 6—Standard booster type wall set circuit.

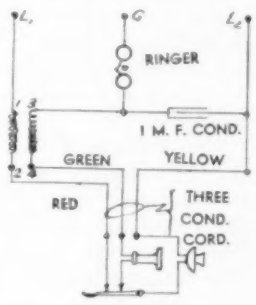


Fig. 7—Standard booster type desk set circuit.

Booster Type C. B. Circuits

The basic booster type talking circuit was given in figure 1. The following diagrams show to number of different types of booster C. B. circuits. The talking circuit is the same as shown in figure 1.

Figure 6 shows the standard booster type wall circuit with the approximate electrical values of the various elements.

Figure 7 shows the standard wiring for C. B. desk stands. Both wall and desk set circuits use a common condenser for ringing and talking circuits.

Figures 8 and 9 show standard circuits for dial desk and wall telephones. It will be noted that the dial has two sets of contacts one of which is operated whenever the dial is off normal, and the other set which acts as the pulsing contacts. The purpose of the off normal contacts is to open the receiver circuit, and short the transmitter during the dialing period. This prevents a clicking noise in the receiver when dialing, and eliminates the variable resistance of the transmitter from the dialing circuit.

Figure 10 shows the circuit of a set connected so as to minimize side tone, or in what is commonly known as an anti-side tone circuit. Anti-side tone connections are sometimes necessary on telephones installed in noisy locations, such as machine shops, where the room noise picked up in the transmitter interferes with hearing the other party. An anti-side tone connection reduces the transmission efficiency of a subset so connected.

Figure 11 shows a booster circuit using two condensers. This arrangement is used on some rural step by step lines, when it is necessary to use a low capacity condenser in series with the ringer in order to keep the total bridged capacity sufficiently low so as not to interfere with dialing.

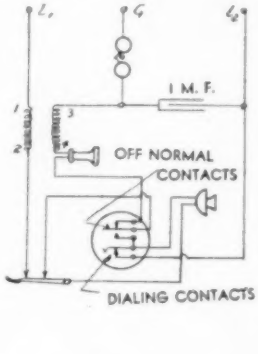


Fig. 8—C. B. booster type dial wall subset circuit (W. E.)

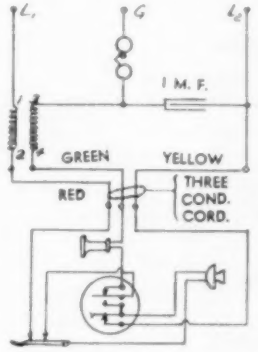


Fig. 9—C. B. booster type dial desk subset circuit

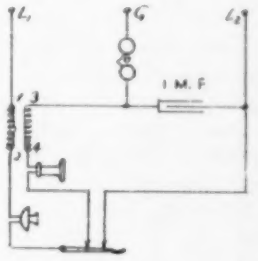


Fig. 10—Booster anti-side tone connection.

Miscellaneous Notes

Common battery induction coils are generally wound to have turn ratios of 1 to 1.2. One popular booster type coil has 1400 turns on the line winding and 1700 turns on the condenser winding. The line winding has a resistance of 14 ohms, and the condenser winding 27 ohms.

Care must be taken in winding up booster type circuits to get the windings properly connected in the circuit, as the manufacturers do not all follow the same method of designating the windings.

It was formerly the practice to use different types of transmitters for local

and common battery sets. This has given way to the practice of using a "universal type" transmitter suitable for either common or local battery telephones. The universal type transmitter has an average talking resistance of around 50 to 60 ohms.

Western Electric transmitters are of the type that can be used interchangeably on local or common battery sets.

The current taken by the average common battery set will range from 40 to 125 milliamperes.

Questions on C. B. Subsets

1.—What is the most efficient C. B. subset circuit?

2.—Why is the booster talking circuit more efficient than the other circuits described?

3.—What value condenser should be used in the booster talking circuit?

4.—Why is it sometimes necessary to connect subsets for anti-side tone and how is this accomplished?

5.—Why are off normal or shunting contacts necessary on dial telephones?

6.—Are C. B. station maintenance costs more or less than on magneto stations?

7.—Why are two condensers used in the circuit shown in figure 11?

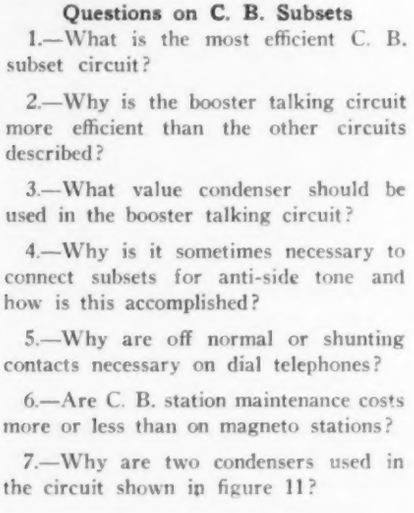


Fig. 11—Booster type circuit wall set (Automatic Electric type 21)

8.—What is considered the average resistance of a C. B. transmitter?

9.—What is the turn ratio of a C. B. induction coil?

10.—What is the approximate range of current taken by C. B. transmitters on various length loops?

Lane Again Chosen Arkansas President

Greatest Sin of Utilities Is That of Silence, Speaker Tells Delegates to Arkansas Telephone Convention

Telephone men in Arkansas were urged to get busy and do their part in the present readjustment taking place in the business world by S. A. Lane of Little Rock, president of the Arkansas Telephone Association at the association's annual convention at the Arlington Hotel, Hot Springs, Ark., May 14, 15 and 16.

The depression has been especially marked in Arkansas where the drought was added to financial difficulties and bank failures, and telephone companies have shared the slump with other businesses.

"We are depressed but not downhearted," insisted President Lane. "We can face the future with confidence. Once we believed that fundamental principles of business were unnecessary and of no consequence, and that our business would go along successfully without work. Now, however, we have learned our lesson and are prepared to extend our best efforts in every line of telephone activity," he said.

He stressed the following as essential to successful telephone operation: giving the fullest measure of service; maintaining plants up to high standards of efficiency; keeping accurate records of the business of all exchanges; keeping customers and employes satisfied; and cultivating the acquaintance of the company's subscribers.

For the third successive year President Lane was chosen to lead the Arkansas association for another year. He is president of the Western Arkansas Telephone company, with headquarters at Paris, Ark. J. A. Wommack of De Queen and R. E. Norris of Berryville were elected vice-presidents; Curtis Stout of Stuttgart was elected secretary, and Ernest Sowell of Little Rock, treasurer.

Speaking on "Our Mutual Interests," C. Hamilton Moses, Little Rock, attorney for the Arkansas Power and Light company, addressed convention delegates, saying that although he usually spoke for the utilities, in this instance he intended to represent the complainants, if any. He said the people do not realize the power they possess. They can elect members of courts and make and unmake the constitution.

The people, he declared, are honest and fair. If the public has acquired a natural prejudice against corporations, it is due largely to misinformation, for which the utilities are in a large measure responsible, he added.

"The greatest sin the utilities have committed is that of silence," he said. "They have not been telling their story."

Utilities and corporations have made some effort, he said, to tell their story through the establishment of a public relations department, and through speakers and literature, but such work has reached only those who are already more or less cognizant of the work of the utilities. The opinion people form of corporations and utilities is largely from contact they have with the working man of those interests, he concluded.

"Merchandising Telephone Service" was the subject of an address by E. N. Widen of St. Louis, Mo.; E. B. Downie, also of St. Louis, general counsel for the Southwestern Bell Telephone company, discussed "The Value of Public Relations"; J. R. Campbell, state representative of Sevier county, spoke on "Taxation of Utilities"; and F. B. MacKinnon of Chicago, president of the United States Independent Telephone Association, addressed the convention on the subject, "Holding the Line."

UNITED COMPANIES ACQUIRE INDIANA TELEPHONES

Negotiations have been completed for the transfer of telephone equipment and real estate in Indiana and the western part of Ohio, representing an estimated value of $6,000,000, from the Interstate Telephone and Telegraph company to the United Companies, Abilene, Kans.

The purchasing company, a holding concern, had owned stock in approximately forty telephone exchanges in the state preceding the deal, having acquired the properties a year ago.

The United Companies, of which C. L. Brown, Abilene, Kans., is president, operates telephone, gas and electric light companies, oil wells and mercantile establishments in Kansas, Missouri, Pennsylvania and Indiana.

The Interstate company is headed by Pierre F. Goodrich. The principal exchanges are in the cities of Warsaw, Plymouth, Columbia City, Lagrange, Portland, Franklin and Kentland.

NEW HONOR TO PROMINENT TELEPHONE MAN

Another honor has been bestowed upon a man prominent in the Independent telephone industry. C. L. Jones, secretary-manager of the Athens Home Telephone company, Athens, Ohio, has been elected president of the Athens Rotary club. Mr. Jones is also a director in the United States Independent Telephone Association and the Ohio Independent Telephone Association.

The list of additional subscribers to the Athens exchange for January, February, and March indicates that the company is growing rapidly.

Submarine Trans-Oceanic Telephone Cable

New Ideas and Suggestions on the Selection of the Proper Trans-Oceanic Cable, as Well as Information on the Actual Manufacture, Shipment and Laying of Submarine Cable Is Contained in This Article Written by Paul Frick, Obertelegraphensekretar Oberpostdirektion Kiel, Germany

Modern improvements in the telephone industry have resulted in a new problem. It has become desirable to connect the telephone networks of the various countries and continents. With regard to Europe and America especially has it been difficult to discover a communication system by which subscribers might carry on a conversation from one land to the other.

The first attempt at a solution of this problem was the wireless telephone connection between New York and London established at the beginning of the year 1927. Since that time several transatlantic telephone highways have spanned the waves of the Atlantic by radio. However, the safe carrying of message by this means has been subject to the temperament of winds and other weather conditions and atmospheric disturbances. At present the privacy of a telephone conversation across the ocean by radio cannot be depended upon, since at certain hours under certain conditions, these messages can be "picked-up" by other wireless and radio stations.

Numerous attempts have been made to correct these undesirable features of trans-Atlantic conversation, including "scrambled speech" whereby the message is broken into unintelligible syllables when it leaves the wire of one country, and converted back into proper order upon reaching the land wires across the ocean. However, telephone engineers generally have felt that trans-oceanic telephone conversation could never be entirely satisfactory until some practical method of laying cables across oceans and seas could be discovered.

The first trans-Atlantic cable to be laid, according to reports, will be between New Foundland and Ireland. This cable will be more than 2,000 nautical miles in length and therefore the longest telephone cable in the world.

Kinds of Trans-Oceanic Cable

Two kinds of cable are known to be qualified for this purpose. They are characterized by their insulation, Gutta Percha and paper. Instead of Gutta Percha, which is not considered a sufficiently good insulator for telephone cables of greater length, analogous substances called Para Gutta or Balata are used, which are known to have better dielectric qualities and even to be cheaper than Gutta Percha. The mentioned ocean cable will be insulated with Para Gutta and fitted up for telephony as well as for telegraphy.

Improving the speech transmission by the insertion of self-induction coils on a scientific basis (coil-loaded cable) or by distributing the self-inductance continuously along the whole length of the cable (continuous-loaded cable) may be employed for both kinds of insulation. Naturally the material to be used for the coils or the continuously loading, acts an important part.

Experiments made in the laboratories of several cable manufacturers as well as in the ocean, have shown that there are no difficulties involved in the use of a lead covered paper-core ocean cable, the lead covering of which is especially protected from the weight of the water.

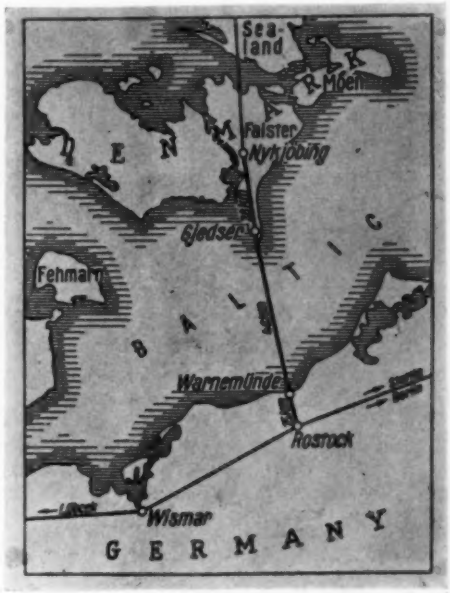


Fig. 1—Running of the cable.

For the most important parts of such an ocean cable, the loading coils, the German cable industry is working out a form, the electrical and mechanical usefulness of which is anticipated.

Few difficulties should be encountered in laying the cable with the aid of modern cable ships, measuring equipments, and so on.

According to publications of Siemens and Halske, in the case of submarine telephone cables, attempts were made until quite recently to avoid loading coils, i. e., the insertion of lumped inductances in long cable lengths, in view of possible difficulties with regard to laying. Hence, in recent years, there were laid out a considerable number of continuously loaded submarine telephone cables the self-inductance of which is not distributed in lumps but continuously along the whole length of the cable. The last doubts, however, respecting the employment of coil-loaded submarine telephone cables, were dispersed by an experiment carried out by the German Reichspost with two coil-loaded submarine cables in the North Sea, which clearly proved the laying of such cables as well as their raising for repair work to be a practical possibility with present methods of laying. Taking into consideration the large economical advantages which a coil-loaded submarine cable secures compared with a continuously loaded submarine cable—especially over long distances—the German Reichspost and the Danish State Telegraph Administration decided to allow the long-planned submarine telephone cable between Germany and Denmark to be manufactured as a coil-loaded submarine cable. The contract for delivery and lay-out of the cable was given to Siemens and Halske, who laid it from the cable ship Norderney, without any mishap.

Laying of Cables in North Sea

Siemens and Halske has given us an interesting description of the running and the design of this cable.

As the map (Fig. 1) shows, the cable crosses the Baltic between Warnemünde and Gjedser on the Island of Falster, and is about 46 kilometers long (1 km. = 0.621 miles = 0.54 nautical miles). Sections of land cable are connected at each end—at the German end the section from Warnemünde to Rostock, about 15 km. long; and at the Danish end the section Gjedser-Nykjöbing, about 28 km. long. The necessary telephone repeater stations are situated at Rostock and Nykjöbing, so that the complete repeater section between the stations is about 89 km. long. The coil-loaded submarine cable is arranged for so-called four-wire working, i. e., four conductors are necessary for each conversation: one double line for the north direction and another for the opposite direction. The cable contains 12 star quads, 3 in the inside layer and 9 in the outside layer (Fig. 2). The 3 quads of the inside layer are combined with 3 quads of the outside layer into a group of quads which comprises the conductors for one direction of speech. The other group of 6 quads of the outer layer comprises the conductors for the opposite direction of speech. The

two groups are electrostatically screened from one another. The conductors are of solid copper wire 1 mm. (1 mm. = 0.0394 inches) in diameter, insulated with paper and air spaces. The core is covered by a seamless compressed lead sheath 2'9 mm. thick, whilst the armouring consists of circular wires of 5 mm. in diameter for the greater part of the length, but of 7 mm. at the Danish end, on account of the bed of shingle to be found there.

Each of the loading coil pieces contains 24 coils, the length of each piece being about 5 m., inclusive of the tapered sleeve to the cable. The coils are protected for the whole of their length by a lead sheath, and armoured with round wires just like the cable. The coil piece spacing is about 2'2 km. long.

Manufacturing and Shipping Cable

The cable was coiled in lengths corresponding to the distances between the loading coils. The loading coil pieces were spliced into the cable in two fitting tents (Fig. 3). Then the cable was stowed away in the transport barge and transferred in the Harbor of Hamburg from the barge into the cable ship Norderney, being carried over pulleys from the barge into the tank of the cable ship (Fig. 4). The laying took place smoothly and without any incident. The laying speed on the actual sea trip amounted, on the average, to 9 km. per hour. Figure 5 shows the machine for laying out the cable, and figure 6 the measuring equipment for electrically testing the cable during the laying-out process. Acceptance tests showed that the electrical properties of the loaded submarine cable exceeded the guaranteed figures specified in the contract.

A cable of the same kind was laid out in September, 1930, between Germany and Sweden connecting the German with the Swedish coast. It was about 120 km. long. Sections of land cable are connected with each end—at the German end about 16 km. and at the Swedish end about 24 km. The new laid cable surpasses all present telephone sea cables of the same length and consideration. The core consists of no fewer than 170 insulated conductors and is arranged for four-wire working.

The distance to be spanned is a matter of greater importance for an ocean telephone cable than for a small single core trans-Atlantic telegraph cable. Considering a telephone cable instead of a telegraph cable the starting point is found to be the repeater input, which is decisive for the transmission loss. Although recently an attempt has been made to raise transmission numbers there always remain certain natural limitations depending upon absence of distortion and quality of transmission.

Concerning a long telephone cable it may be said in the first place that the repeater section determines economy of the cable. For a diminution of the section permits the construction of a cheaper cable with the same number of circuits or—and what is still more important—the inclusion of more circuits in one cable.

It's quite obvious that greater importance is attributed to these factors for ocean cables of many thousands of miles in length than for underground cables, the repeater sections of which may be chosen nearly any length, because repeater stations may be built in all places. On the seaway between two coasts there are—with the exception of several groups of islands—no possibilities for that purpose.

For some time the industry has endeavored to make an ocean telephone cable a practical possibility. At present the project is still in a state of research and preparation. However, the design now being worked out may prove to be well qualified for being put into actual practice. The industry is aspiring to create a reliable telephone connection between America and Europe with the aid of a cable insulated with paper and air spaces, the core of which is covered by a seamless compressed lead sheath. Such a cable would be more economical than one insulated with Gutta Percha, Para Gutta or Balata.

Projects Absorbing Engineers

Engineers today are absorbed in two projects. The former has often been published in the technical press of all countries: the floating islands. Naturally there are many difficulties, but already the idea seems to be practicable. As far as we have been informed the first floating island is being built in the northeast of the Bermuda islands, in accordance with Engineer Armstrong's model, which has been floating on Lake Michigan for the last few months.

It is not the plan of an ocean telephone cable, but that of an ocean air-service that must be considered as the cause of such peerless building. Because of the prevalent winds a reliable air service is only possible on the southern lines. Eight floating islands are planned between America and Europe. Placing repeater stations on these iron islands seems to be simple and logical.

The distance from the German coast

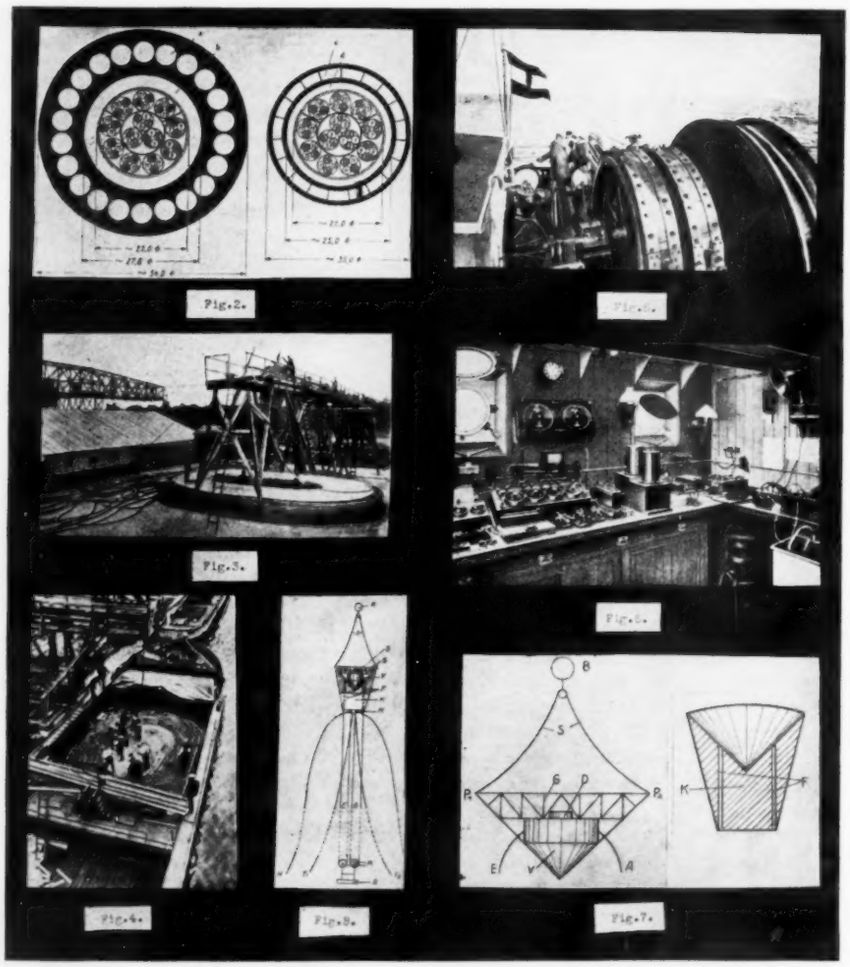


Fig. 2—Diagram of cable. Fig. 3—How cable is coiled. Fig. 4—Barge carrying cable from harbor to cable ship. Fig. 5—Machine for laying cable. Fig. 6—Equipment for electrically testing cable. Figs. 7 and 8—Diagrams of floating repeater station.

to the mainland of the United States amounts to nearly 8,000 kilometers. Eight intermediate islands would result in average repeater sections of less than 1,000 km. in length. The technical discoveries of our time allow us to span such a length with a cable containing several circuits and arranged for double line operation or for so-called four-wire working, i. e., four conductors for each conversation: one double line for the one direction and another for the opposite direction. Thus the establishment of a repeater station on each of the eight islands is not even necessary. If such an ocean telephone cable takes its way from the American mainland over the Bermuda islands and the Portuguese or Spanish coast—here setting up a connection with the European land lines—the following distances are spanned:

American mainland-Bermuda islands = about 1,200 km., Bermuda islands-Azores = about 3,300 km., Azores-Portuguese or Spanish landing-place = about 2,000 or 1,800 km.

Supposing that one repeater station could be placed in the middle of each of the last two lengths, there is every chance of keeping the first costs of a trans-Atlantic telephone cable within bounds that assure an economical success.

Floating Repeater Station

The second project for the successful laying of a trans-Atlantic telephone cable has been designed and patented by the German cable manufacturers, Felten & Guilleaume. It is based upon the fact that in a depth of nearly 100 m. there are no currents. Instead of the floating islands, small floating repeater stations are provided for. These would not be lowered in greater depths, nor let down upon the bottom of the ocean, but would be kept floating under the surface of the water in a depth of 80 to 100 m.

As shown in Figs 7 and 8, a floating repeater station consists (1) of a body, *K*, serving as a support, the surface of which forms a tapered hollow space; (2) of the repeater-box, *V*, with the hawsers, *A* and *E*, which also contain the cable leading to the repeater.

The cables lead over rolls, *R*, to which is attached a load, *Q*, keeping the swimming station in the desired depth. The entrance to the interior of the repeater-box is to be found near the point *D*.

The repeater-box consists of a special metal which cannot be destroyed by sea water. The interior is filled up with cork or with another substance of a small specific gravity. The cables (*A* and *E*) leading to the repeaters enter the box through two cylindrical openings, *F*.

The box is surrounded by a lattice-work giving mechanical support to the building. To the points P_1 and P_2 there is attached the wire-rope being fastened with the aid of a rope to a small buoy, *B*.

The telephone cable, *H*, comes up in two bows from the sea-ground. The cables, *A* and *E*, leading to the repeaters are connected up with the telephone cable by the socket, *M*. The floating repeater station is being anchored by the two steel chains, T_1 and T_2. Supposing that there is a depth of 5,000 m., the practical buoyancy of the whole station is 54 tons.

In laying out the ocean cable the cable ship only needs to fasten the two ends of the telephone cable as well as those of the terminal cables *A* and *E* to the repeater-box, while the other installation is taken in hand by a smaller ship. The floating box would be placed into the desired depth with the aid of the steel chains, T_1 and T_2, and the load, *Q*.

Taking into consideration the relative depth, there is no doubt but the required mechanical density of the repeater station may be obtained. We have been informed that in the Atlantic a short time ago an American deep-sea expedition succeeded in reaching a depth of nearly 1,500 feet with the aid of a manned steel ball, and that no mishap occurred.

Marking the place of the station by a buoy fastened to the station itself is not considered serviceable; the patent believes it to be better putting several buoys in some distance from the station. These buoys will be sufficient to locate the station at all times. The suspension of *B* with the aid of the large bow of the wire rope, *S*, makes it easy for a drag-anchor to cling to the rope. The same considerations are intended for the repair work.

The patent shows that the routine maintenance is possible without too heavy costs. The repeater station is to be fitted out with storage batteries as well as with dry cell batteries.

According to the patent the floating repeater station guarantees a reliable service for one year at the least, without any maintenance.

In whatever light the project in question may be taken, there is no doubt but the industry is able to carry it out. Taking into consideration the strange things we already experienced, there certainly is ample reason to believe that floating repeater stations are more than a phantom.

Book Review

Bulletin of the National Research Council, the fourth edition of a directory of industrial research laboratories of the United States, is just off the press. It was compiled by Clarence J. West and Callie Hull for the research information service of the National Research Council, and published by the National Research Council of The National Academy of Sciences, Washington, D. C. The price of the bulletin is $2.

The fourth edition of this publication should encourage those interested in the progress of industrial research, showing as it does a 60 per cent increase in the laboratories listed over those in the 1927 edition. More than 1,600 laboratories are listed in this bulletin as compared with 1,000 laboratories in the third edition.

The names of those comprising the research staff are given, together with the name and address of the laboratory, and there is a short outline of the nature of the research work carried on by each laboratory. Use of the bulletin for reference has been greatly simplified by the addition of three indexes at the back of the book. There is an index of names, a geographical index, and an index of subjects.

Audel's New Electric Library, Volume IX, by Frank D. Graham, B. S., M. S., M. E., E. E. Discusses electricity as applied to the radio, telephone, telegraph, television, motion picture, and talkies. For Engineers, electricians, mechanics, and students. Bound in red leather to match other 11 volumes of "Electrical Library."

The author, following the popular appeal for practical knowledge, has prepared this progressive series for the electrical worker and student; for all those who are seeking electrical knowledge as a life profession; and for those who find that there is a gap in their training and knowledge of electricity.

Simplicity is the keynote throughout this series. From this progressive step-by-step method of instruction and explanation, the reader can easily gain a thorough knowledge of modern electrical practice in line with the best information and experience.

Volume nine, as indicated above, is the volume particularly applicable to telephone men. Radio principles, vacuum tubes, principles of receiver circuits, radio circuit diagrams, short waves, aerials, loud speakers, broadcasting stations, inter-communicating telephones, telephones and telephone troubles, the telegraph, optics, motion pictures, cameras and projectors—these are some of the subjects discussed interestingly and expertly by Dr. Graham.

The book is beautifully bound and fully illustrated with diagrams and sketches, including calculations and tables for ready reference. There are also helpful questions and answers, as well as trial tests for practice, study, and reviews.

VACUUM TUBE THEORY AND PRACTICE

SUBJECT: THE VOLUME INDICATOR TRANSMISSION TEST SET

General

In the April issue of TELEPHONE ENGINEER the theory and design of vacuum tube voltmeters was discussed. This article will describe a transmission test set which utilizes the vacuum tube voltmeter as the balancing element in place of a listening observer.

The use of an indicating meter in place of an observer is an advantage as a more accurate test is possible and the necessity for two testers is eliminated.

Under the title of "Comparative Transmission Tests" (November, 1930), a method for testing subscribers' instruments in the shop was described. This method consisted in making talking tests over a standard subset and a line having a fixed loss of 20 db, and over the subset under test and a line having a variable loss of from 0 to 30 db. The variable loss pad is adjusted so that the listening tester hears the same voice level over the fixed and variable lines. The efficiency of the subset under test as compared to the standard is then determined by the difference in loss cut into the two lines.

It will be seen that the "volume indicator transmission test set" is similar in theory to the "transmission comparison circuit" with the exception that the voice level received over the fixed and variable lines is impressed on the volume indicator, instead of a telephone receiver. Figure 1 shows schematically the elements of the transmission comparison circuit and Figure 2 the elements of the volume indicator transmission test set.

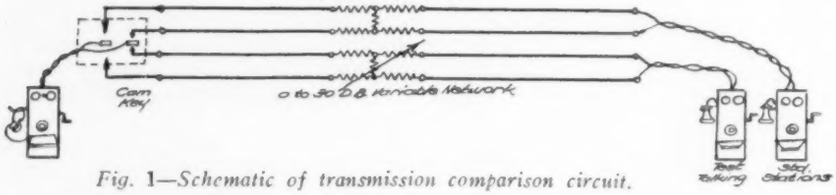


Fig. 1—Schematic of transmission comparison circuit.

Description of Volume Indicator Transmission Test Set

Figure 3 shows the circuit of a volume indicator transmission test set suitable for making tests on subscriber's instrument and parts.

The arrangement shown is suitable for testing both common and local battery sets.

Key No. 1 is provided to connect either the standard L. B. or the standard C. B. set to the testing network. In magneto offices this key and the standard C. B. set may be omitted. The common battery feed circuit to the mid point of the repeating coils may also be omitted where no common battery phones are to be tested.

It will be noted that jacks are provided for connecting the standard elements (transmitter and receiver) into the standard subset circuit. This eliminates the necessity for having two sets of standard elements.

Key No. 2 is used to throw the volume indicator from the fixed to variable network.

Key No. 3 is used to connect the C. O. battery to the repeating coils when testing common battery sets. The resistances, R_1, R_2, are necessary to reduce the battery current through the transmitter to a value comparable to the current supply condition on a one-mile No. 24 gauge loop.

The repeating coils serve to keep the small D. C. potential which exists across the line terminals of a local battery desk set from being impressed across the input tube of the volume indicator. They are, of course, also necessary for battery feed purposes.

Provision is made for measuring the transmitter current of the standard and transmitters under test by means of jacks placed in the battery circuits. A Weston model 301-0 to 200 milliammeter can be used for this purpose. The current taken by a transmitter under local battery conditions is a good index of the condition of the transmitter.

The variable loss networks consist of "voltage divider" type pads, the fixed network having a loss of 15 db, and the variable network a loss of 0 to 20 db. The voltage divider type network is suitable for use with a vacuum tube volume indicator as the input impedance of the volume indicator is sufficiently high to permit using a simple network without upsetting the calibration of the network.

The volume indicator shown is the two-tube arrangement shown in the April issue of TELEPHONE ENGINEER.

The elements of the standard subset are of Western Electric manufacture but other equipment can be used with approximately the same results. The equipment should be mounted in a suitable cabinet with meters mounted so they can be conveniently read.

Figure 4 shows the schematic wiring of a volume indicator type transmission test circuit which is intended for use in shop testing where a large number of subsets are tested. It differs from the small exchange model primarily in the arrangement for testing individual transmitter, receivers, induction coils, etc. In the small exchange model this is accomplished by connecting the items into the circuit of a subset attached to the subset test terminals.

In the shop model this is accomplished by substituting the individual element under test for the standard element. Keys are provided for quickly throwing from the standard to the element under test.

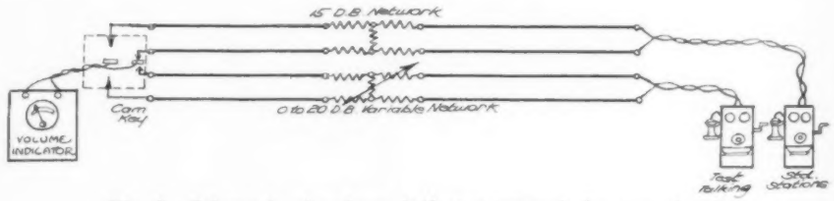


Fig. 2—Schematic of volume indicator transmission test circuit.

An additional key (No. 5) is also required to throw the standard set to the variable net work when talking over the element under test.

The principal advantage of this circuit as compared to the small exchange arrangement is the greater convenience in testing individual elements, as well as being somewhat more accurate especially in connection with induction coil tests.

Figure 5 shows a panel arrangement suitable for the shop model. Test clips are provided for quickly connecting subsets, transmitter, or receivers to the testing circuit.

The following instructions describe the testing procedure to follow in using the small office or shop model transmission test circuits.

Operating Instructions—Small Office Model Test Set

Common battery subsets are tested as follows: Turn on volume indicator, adjust grid bias control so that the meter reads 50 microamperes. Next adjust bucker rheostat so that the needle falls back to zero.

Step 2—Connect the subset to be tested to test terminals X_1 and X_2, throw key No. 1 to the common battery subset. Plug the standard transmitter and receiver into the standard jack.

Step 3—With key No. 2 thrown to the fixed network, repeat the test word "retribution" several times in the standard transmitter. Speak in a normal tone with the lips held about one-half inch away from the transmitter. Note the maximum meter deflection when the test word is spoken.

Step 4—Next throw key No. 2 to the variable network and repeat the test word several times in the transmitter of the subset under test. Be careful to maintain the same voice level and the lips the same distance from the mouthpiece. Adjust the variable network so that the meter indicates the same deflection as when talking over the standard transmitter and fixed network. The transmission efficiency of the subset under test as compared to the standard transmitting circuit is then equal to the difference in the setting of the variable and fixed networks. For example, if a balance were obtained with 5 db cut into variable network then the efficiency of the set under test as compared to the standard set would be 15 minus 5 or 10 db poorer than the standard.

Step 5—The receiving efficiency is determined by exactly the same procedure as was the transmitter efficiency except that the standard and test receiver *are used as transmitters by talking directly into the diaphragm.* The transmitter circuit should be open or the transmitter mouthpiece covered when making this test. (Note: This method of testing receivers, while not highly accurate, is sufficient and will permit uncovering receiver defects.)

Local battery subsets are tested by the same procedure as outlined above except that key No. 1 is thrown to the local battery standard set and the common battery current supply is opened by means of key No. 3.

Transmitters, receivers and induction coils are tested by substituting in a second standard set which is connected to terminals X_1 and X_2. This second standard set may consist of a new common battery or local battery set having clips on transmitter, receiver and induction coil wires so that the elements under test can be quickly connected to this set.

Operating Instructions—Shop Model

Subsets are tested in the shop model in the same manner as described for the small office model. Individual transmitters, receivers and induction coils are tested by substituting these in place of the standard elements. Clips are provided to which the apparatus to be tested is connected. By talking alternately into the standard apparatus and the apparatus under test and by means of keys Nos. 5 and 6, throwing the volume indicator standard set first from one network to the other, the transmission efficiency of individual items can be evaluated in the same manner as described for subsets. It will be noted that keys are provided for quickly throwing from the standard to the test apparatus. In order to facilitate the switching operation keys No. 5 and No. 6 should be so arranged that they can be thrown simultaneously with the key controlling the standard and test element. This can be accomplished by mounting the keys in a row and mechanically coupling the keys together by

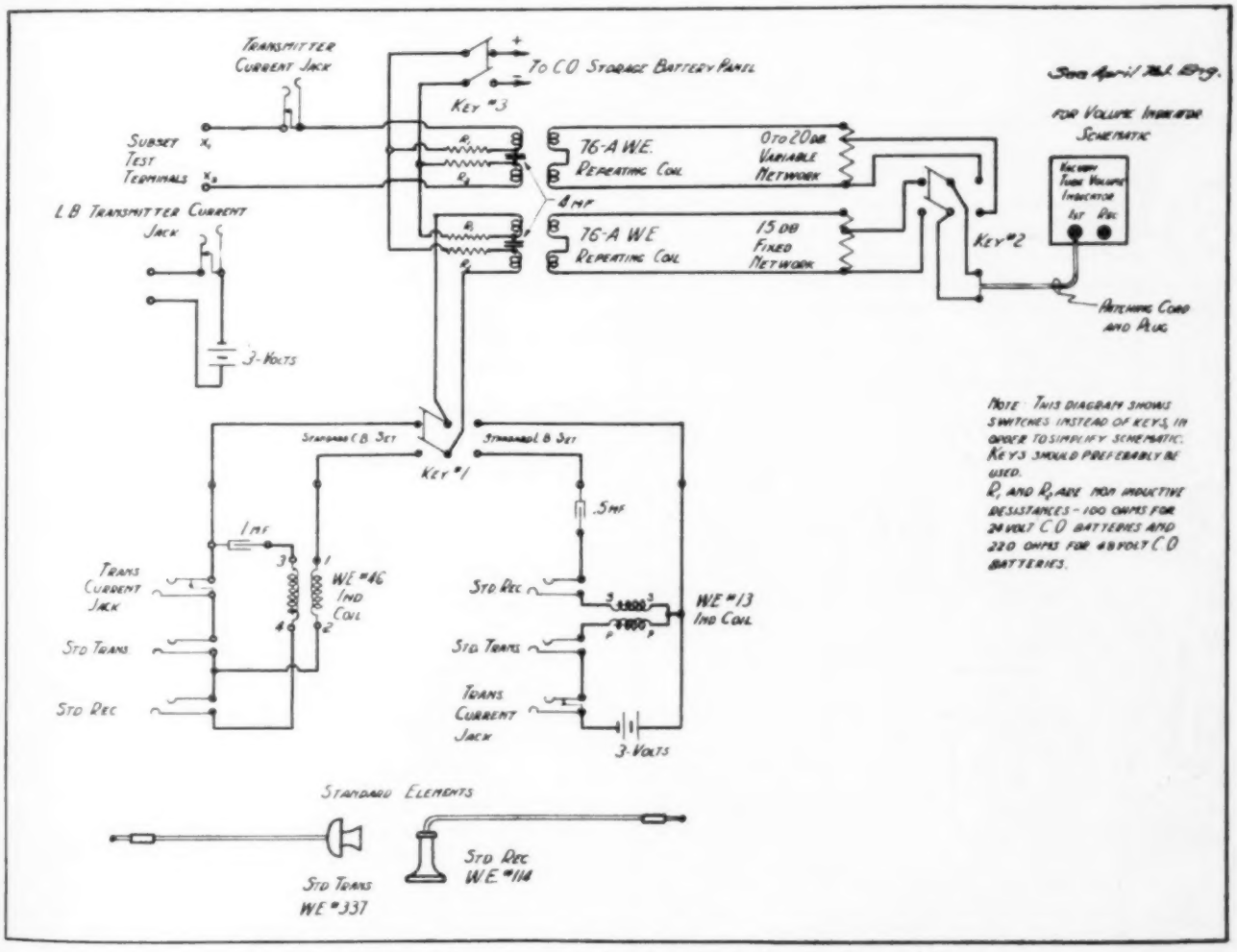

Transmitter Current Jack
To C.O. Storage Battery Panel
Key #3
Subset Test Terminals
76-A W.E. Repeating Coil
0 to 20 db Variable Network
4 mf
76-A W.E. Repeating Coil
15 db Fixed Network
Key #2
L.B. Transmitter Current Jack
3-Volts
Standard C.B. Set
Standard L.B. Set
Key #1
1 mf
.5 mf
Trans Current Jack
Std Trans
Std Rec
WE #46 Ind Coil
WE #13 Ind Coil
Std Rec
Std Trans
Trans Current Jack
3-Volts
Standard Elements
Std Trans WE #337
Std Rec WE #114
Note: This diagram shows switches instead of keys, in order to simplify schematic. Keys should preferably be used.
R1 and R2 are non inductive resistances - 100 ohms for 24 volt C.O. batteries and 220 ohms for 48 volt C.O. batteries.

Fig. 3—Volume indicator transmission test circuit (small office model). . .

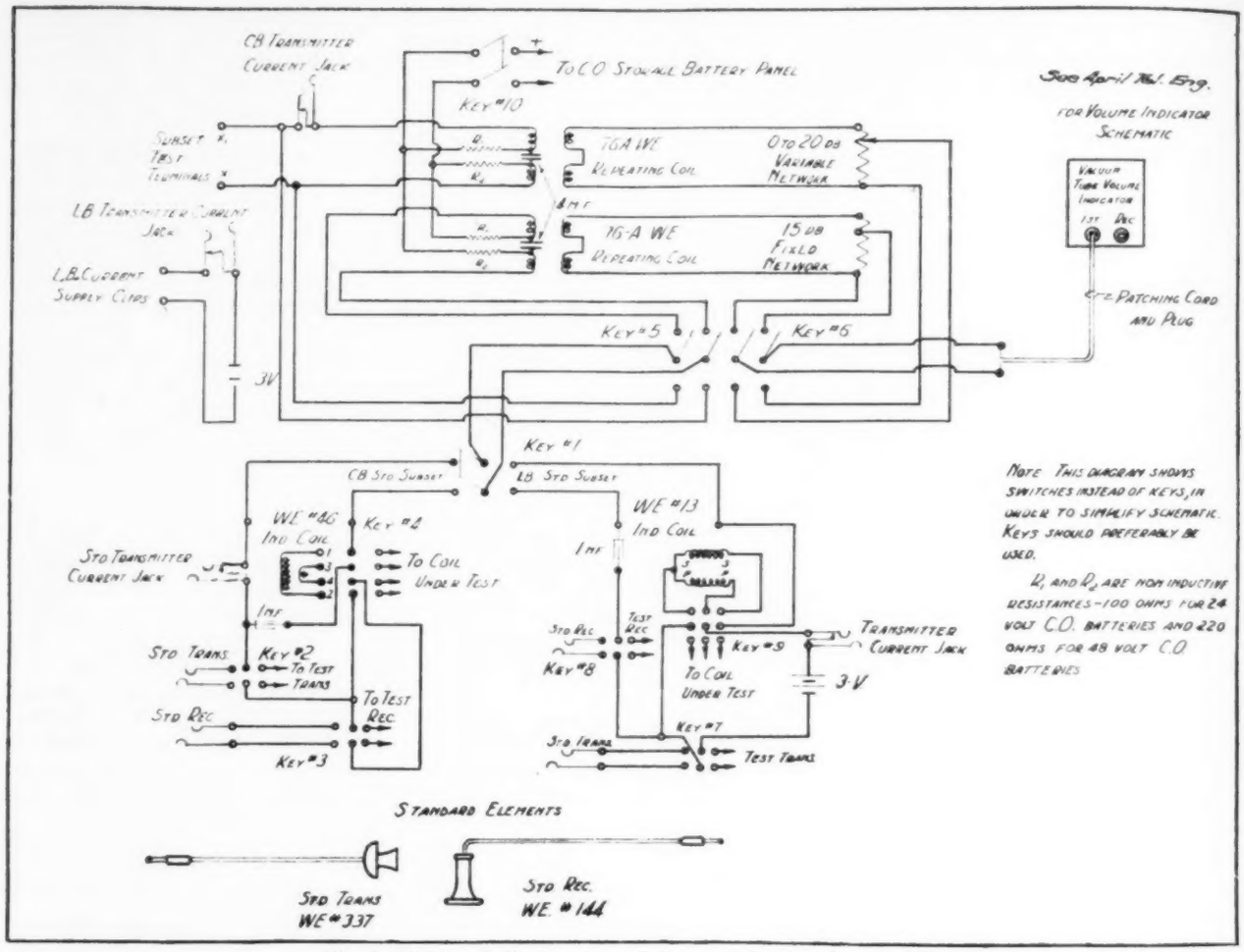


Fig. 4—Volume indicator transmission test circuit (shop model).

means of a metal cross bar to which is soldered small brass sleeves large enough to fit over the key handles.

The volume indicator transmission test set is primarily intended for measuring the efficiency of telephones and parts which are returned to the shop for repair, or which are recovered on station moves and removes. It is recommended that all telephones and parts which are removed from actual service be tested at the time they are returned to the shop. If they test O.K. they should be thoroughly inspected and cleaned and placed in stock with a tag attached stating that

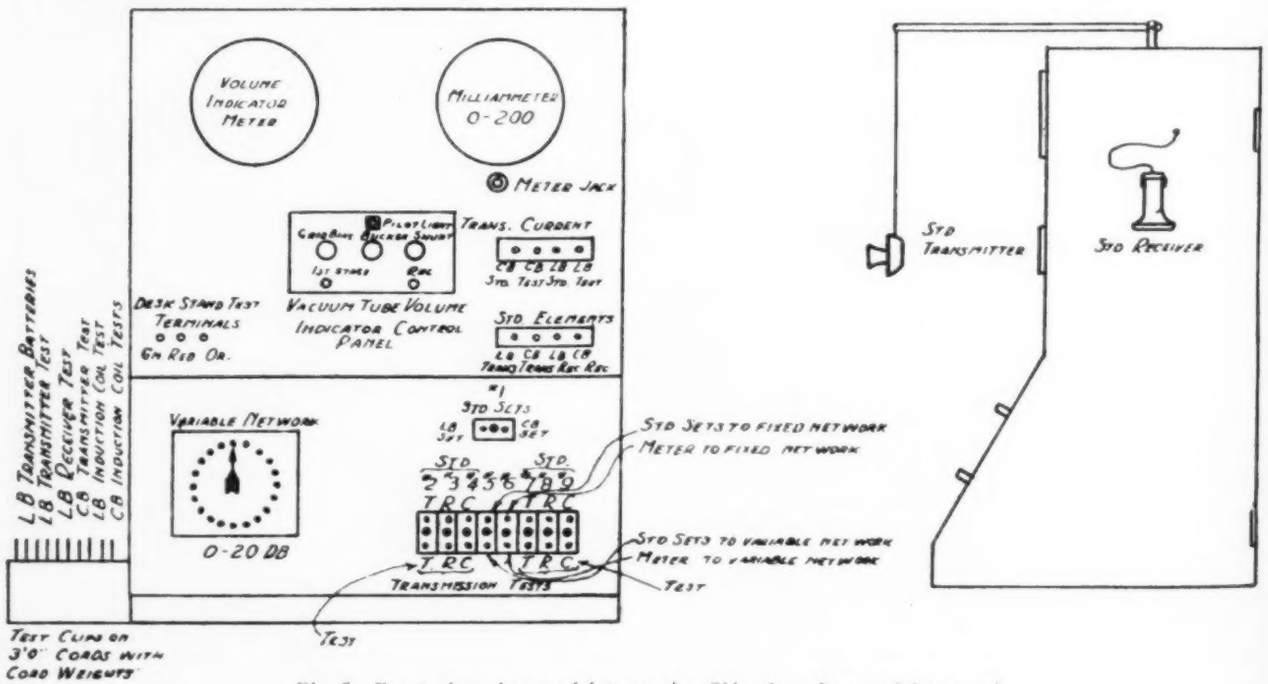


Fig. 5—Front view shop model test unit. Side view shop model test unit.

they are satisfactory for reuse when needed.

Apparatus which tests bad should be examined for faulty adjustment of parts and if possible repaired. If the unit cannot be repaired it should be either returned to the factory for repair, or junked. "Poor talk" apparatus should not be allowed to accumulate or lay around in the storeroom for sooner or later it will find its way back into plant.

New telephones and parts which are purchased should be tested to see how they compare to the standards.

Miscellaneous Notes

The test word "retribution" was selected because it is so composed that it gives a prolonged deflection of the volume indicator needle hence is easier to read. Any word which will accomplish this and which approximates the average voice frequency in its characteristics would be suitable.

Constant frequency (1,000 cycle) tests were found to give inaccurate results due to receiver and transmitter diaphragm resonance effects.

The Lincoln Engineering company, 855 South 32nd, Lincoln, Neb., has a complete stock of parts for building the volume indicator transmission test circuit which are available at wholesale prices to telephone companies. Any question or information on the circuit may be taken up directly with that company.

(FINIS)

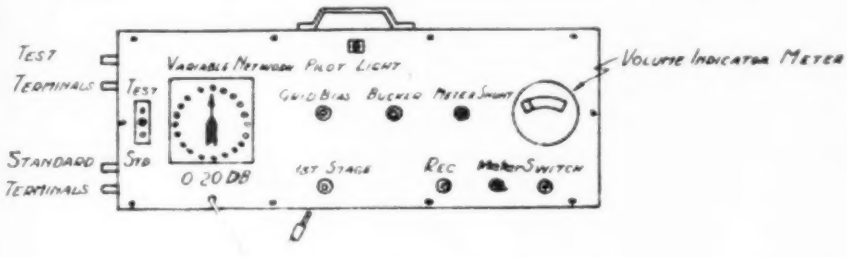


Fig. 3-A—Front view of panel, small office model.

TELEPHONE COMPANIES REACH TOLL AGREEMENT

In clause No. 8417, journal entry 1900, the Oklahoma Corporation Commission approved an agreement between the Oklahoma-Arkansas Telephone company and the Southwestern Bell Telephone company, which is supplementary to the temporary order of the commission, April 22, 1931, relating to toll business at Poteau, Heavener, Howe and Wister.

The journal entry, pursuant to the agreement, provides that the order of April 22 shall apply to interstate as well as intrastate business, and that the toll board of the Southwestern Bell Telephone company at Poteau shall be removed for all purposes before May 5. It also provides that service shall be restored between the Southwestern Bell Telephone company and the Oklahoma-Arkansas Telephone company as it prevailed at Poteau, Heavener, Howe and Wister prior to January 22, 1928.

The compensation, as provided in the order of April 22, shall apply to interstate as well as intrastate business during such time as interstate messages shall be handled by such companies under the agreement. The order is without prejudice to the right of either party to discontinue connection with the other on interstate toll business upon thirty days' notice given by one party to the other.

The bond required of the Oklahoma-Arkansas Telephone company shall guarantee payment of interstate as well as intrastate toll collections.

THEY HAD TO SEE PARIS

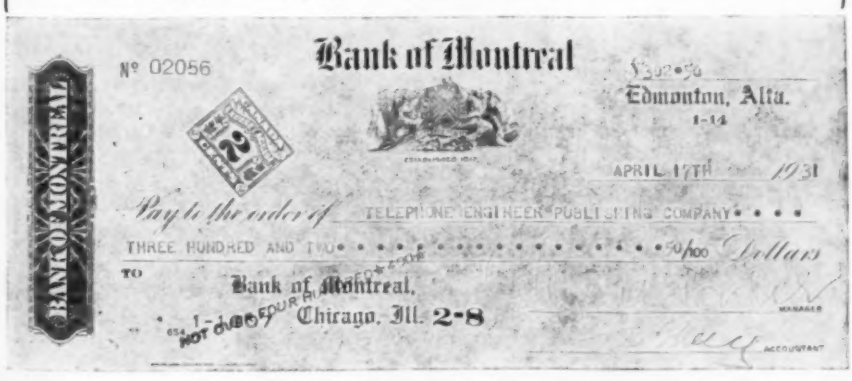
J. Warren Safford, president of the Troy Telephone company, Troy, Ohio, will sail for Europe in June for a month's visit in foreign capitals. Mr. Safford will be accompanied by Mrs. Safford and a daughter. Mr. Safford is a former president of the Ohio Independent Telephone Association, having gone out of office after serving for three years, at the April meeting this year.

Telephone Men at Home and Abroad Accept "Telephone Engineer" As Authority

Checks, arriving at the TELEPHONE ENGINEER publishing office, from many foreign countries as well as our own United States, represent a continuous and eloquent testimonial of the general appreciation of the technical information published monthly in TELEPHONE ENGINEER.

One of the gratifying checks received recently is reproduced below. It was received in payment of renewal subscriptions from the Canadian Government for telephone men employed by government telephone companies in the Province of Alberta only.

Inquiries, as well as checks, arrive at the TELEPHONE ENGINEER office in every mail, and a constantly increasing number of them are from telephone men in foreign countries. These inquiries are usually concerned with engineering data. Each is given individual attention, for TELEPHONE ENGINEER is always happy to furnish any of the vast store of technical engineering information at its disposal to any persons who write for it.



CONVENTION SCHEDULE

Vermont Telephone Association, Rutland, June 16 and 17.

Canadian Western Counties Telephone Association, London, Ontario, June 23.

New Hampshire Telo. Ass'n, Warner, June 23.

Northern Indiana Telephone District Association, South Shore Inn, Lake Wawasee, June 23, 24, and 25.

Independent Telephone Association of Washington, Elma, June 26 and 27.

TELEPHONES EXTEND TWO MILES BELOW GROUND

Telephone service has been extended into the air, to airplanes in flight; to far-off countries; and now almost two miles down into the crust of the earth.

At the Red Jacket copper mining shaft of the Calumet and Heckla Consolidated mining company of Calumet, Mich., a telephone system 9,000 feet beneath the surface has been recently placed in operation. The installation of the telephone system in the very depths of one of the world's deepest copper mines has already saved much time and trouble in getting messages to and from foremen down there.

OUT-OF-TOW
SERVICE

presented to the home telephone subscriber

in terms of friendly, comfortable living

ONE of the pleasant, human aspects of telephone service is the part that out-of-town calls play in keeping friends and family in close and constant touch. But the fact that these calls can be made as quickly and easily as any other, at surprisingly slight cost, is not always understood by the woman in the home—upon whom such duties devolve.

Accordingly, advertisements like those on the opposite page are appearing regularly in women's publications.

These advertisements have been designed to be helpful, informative, interesting. Their captions suggest specific uses and occasions for employing residential toll service—to re and friends, to shops and stores in other —to children away at school or college— family scattered on vacation—whenever dings, birthdays or anniversaries of any occur. Conversational sub-captions presen telephone as the easiest, most natural, personal instrument for each individual pose. Text elaborates the basic idea and rates for various distances to show low

Advertising of this nature reaches mil of women every month and all telephone panies, whether Bell or connecting, shar its benefits.

An Advertisement of the American Telephone and Telegraph Comp

Every *out-of-town telephone call* is a round trip

". . . Yes, Junior's out of bed and the family's back to normal. . . . Is Mother still there with you? . . . Will you be home if we drive over Sunday?"

* * *

On many occasions, it's so easy, swift and simple to travel out of town by *telephone!* In a very few minutes, you've made a round trip. Your questions are answered and you have *all* the news. It's personal and very satisfactory!

The telephone in your home is a fine way to keep friendships alive. When members of the family are traveling or away at school. When friends move to other cities. When there are birthdays or anniversaries or special events of any kind.

Call one of your out-of-town friends today. The cost is surprisingly low. To most places 25 miles away, the day station-to-station rate is about 25 cents; 75 miles, 50 cents; 125 miles, 75 cents; 150 miles, 80 cents. During the evening and night periods, rates are even lower.

Telephone your good wishes to bride or groom or graduate

"We can't get away, Jane . . . Tom's too busy . . . but we'll be thinking of you both and wishing you all sorts of happiness."

* * *

The open season for weddings and commencements is at hand. One can't be present at *all* the ceremonies . . . in various cities at various times.

Next best, is a telephone call to the bride or groom or graduate. It is convincing evidence of your interest. It is *personal.* Your voice carries a sincere and friendly warmth. And whether you call next door, the next city or the next state, telephoning is easy, quick and *inexpensive.*

For out-of-town calls to places 25 miles away, the day station-to-station rate is about 25 cents; 40 miles away, 35 cents; 75 miles, 50 cents; 125 miles, 75 cents; 150 miles, 80 cents. Many rates are lower during the evening and night periods.

Characteristics of Strowger Relays*

Discussion of the Various Methods Used to Determine Mechanical Adjustment Values of Horizontal Relays Together with Reference Tables Governing These Values

By K. W. GRAYBILL
Research and Development Department, Automatic Electric Inc.

The selection of mechanical adjustment values to provide desired contact pressures on make and make-before-break springs, and the use of non-operate current values to control break contact pressures on horizontal relays was discussed in detail in the second article of this series.

It seems desirable at this point to discuss more fully the selection of the various mechanical adjustment values. The armature of the horizontal relay is assembled to the heelpiece with an air gap between these parts which must be perceptible, but not greater than .004 inch, with the armature in the operated position. The existence of this air gap prevents bind as the armature operates. Limiting the air gap to such a small value as .004 inch assures satisfactory sensitivity.

The residual screw adjustment for the majority of relays (specified as .0015 inch) requires that with the armature operated there shall be an air gap between the armature and core which shall be perceptible but not greater than .004 inch at the closest point. The existence of the residual air gap assures satisfactory release of the armature. Limiting the air gap to .004 inch avoids reduction in sensitivity which would result if this air gap were permitted to be larger.

Special operating conditions frequently must be met where sensitivity is of secondary importance and quick release or release with a small current flowing in the coil must be obtained. Such special conditions are met by adjusting the residual air gap to .003, .006, .009 or .012 inch (plus or minus .002 inch from specified value is allowed in adjustment).

The selection of an armature air gap value at which the make contacts will just touch the armature springs is determined by the thickness of spring material and make contact pressure required according to the tables similar to Figure 6 of Article 2.

Referring to Figure 1 of this article, it will be observed that .006 inch has been specified for the make contact adjustment of all assemblies. This value is used under normal conditions for 26 gauge make contact springs and 28 gauge armature springs and results in approximately 35 grams pressure for each make contact with the armature operated. The adjuster meets this requirement as follows: a gauge .006 inch thick is inserted between the residual screw tip and coil core and the coil is energized so as to cause the armature to be attracted against the thickness gauge. While the armature is held in this position with the tip of the residual screw .006 inch from the coil core, the make contact springs are adjusted to just touch the armature spring contacts. A gauge .001 inch larger (.007 inch) is next used in the same way and the adjuster inspects to see that the make contacts do not touch the armature springs with this larger armature air gap.

The normal contact separation between springs such as No. 2 and No. 3 of assembly C in Figure 1 is determined by the difference between the break contact gauging (.010) and the make contact gauging (.006). This difference of .004 (.010 — .006) has been selected for general use because it permits reasonable manufacturing variations in the specified values without requiring too large an armature stroke. This difference of .004 is also used to determine the stroke gauging value when no back contacts are used as in assembly B or D of Figure 1, or the gauging for an outside break combination which has a make or make-before-break combination beyond it as in assemblies E and G of Figure 1.

For successive break combinations in large assemblies, gauging values are specified which differ by .001, with the smallest value assigned to the outside break combinations as illustrated by assemblies E, F and G of Figure 1. For assembly E of Figure 1 the outside break gauging is .010 to provide the usual .004 difference between the break and make gauging. For assembly G of Figure 1 the inside break assembly gauging must be .013 so as to be .004 greater than the .009 make gauging for the make-before-break assembly. The sequence gauging for a number of break combinations in one assembly permits each armature spring to rest the major part of its back pressure against its associated back contact spring.

Having selected spring gauging values, it is possible to calculate the armature

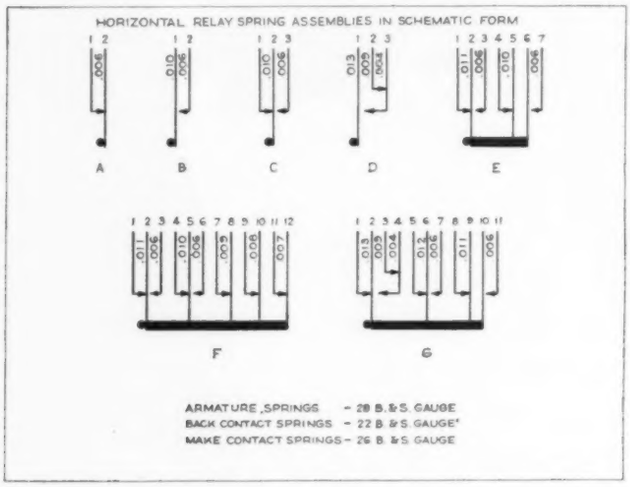
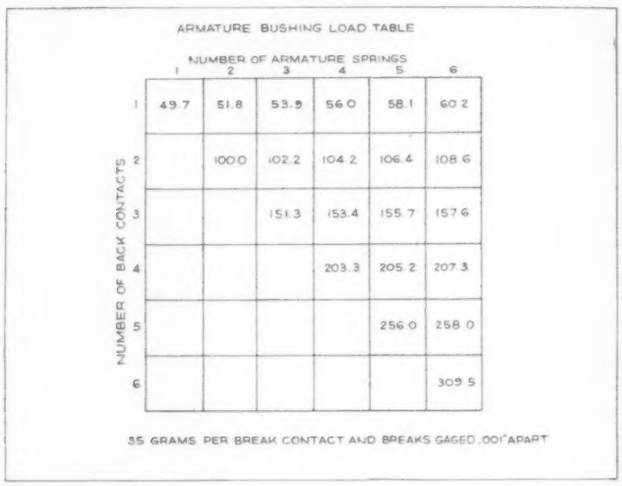


Figure 1


ARMATURE BUSHING LOAD TABLE
NUMBER OF ARMATURE SPRINGS
NUMBER OF BACK CONTACTS
35 GRAMS PER BREAK CONTACT AND BREAKS GAGED .001" APART

NUMBER OF BACK CONTACTS	1	2	3	4	5	6
1	49.7	51.8	53.9	56.0	58.1	60.2
2		100.0	102.2	104.2	106.4	108.6
3			151.3	153.4	155.7	157.6
4				203.3	205.2	207.3
5					256.0	258.0
6						309.5

Figure 2

*Editor's Note: This is the first half of article 3 of a series by Mr. Graybill dealing with relay characteristics. The second half will appear in the next issue.

bushing load as the last break contact just opens as discussed in Article 2 of this series. To avoid calculating this load for each relay, tables similar to that in Figure 2 have been prepared. The table in Figure 2 gives the armature bushing load for various single pile-up spring assemblies when 28 gauge armature springs and 22 gauge back contact springs are

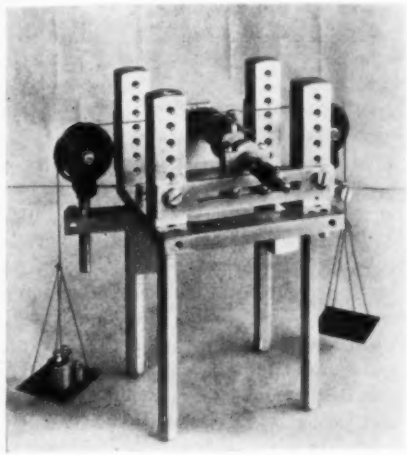


Figure 3

used with 35 grams normal contact pressure on each back contact. The various assemblies covered by this table are assumed to have all break, break-make, or break-make - before - break combinations nearest the heelpiece and all make or make-before-break combinations on the outside of the assembly. Therefore, where there are more armature springs than back contacts, the extra armature springs will all be resting on the outside break contact spring.

As explained in Article 2, the desired back contact pressure is obtained during manufacture by applying a non-operate adjust current value which develops sufficient magnetism to produce a pull at the armature bushing just equal to the bushing load which corresponds to the desired contact pressure as the last break contact opens. With this non-operate current applied to the relay, the adjuster "tensions" the armature springs by adjustment until the last break contact remains closed.

The force developed by a certain current through a coil is proportional to the product of the turns in the inductive winding multiplied by the current through this winding, i.e., the ampere turns. The relation between force at the bushing and ampere turns has been determined by tests made on the special jig illustrated in Figure 3.

Test relays were mounted in the special jig so that gram weights could be attached directly to the armature bushing. A micrometer head was rigidly mounted opposite the residual screw in the armature to serve as an armature back stop. By means of this micrometer head which was calibrated in steps of .0001 inch, the armature stroke used during a test could be determined with a high degree of accuracy. The test coils used were wound with exact numbers of turns of silk insulated wire. The use of silk insulated wire in the test coils practically eliminated the possibility of shorter turns, causing errors in data. Data was then taken with different armature strokes by hanging various weights from 5 grams up to 400 grams on the armature and adjusting the current in the coil for each load so the armature would just operate.

In obtaining relay pull data it is necessary to eliminate the effect of residual magnetism which would accumulate from successive tests on an individual structure. This can be accomplished by completely demagnetizing the test structure for each test reading, or by taking data first with the residual magnetism aiding, and second, with the residual magnetism opposing the test currents and averaging the two sets of data. This latter method consists of magnetizing the relay with either an aiding or opposing current just previous to each test reading and the average data thus obtained is practically the same as that secured by the much longer process of demagnetizing the relay before each test reading. The power developed by any horizontal relay coil, regardless of its resistance, will be practically the same as that developed under any given test condition if the product of the current through the coil and turns in the winding equals the value of ampere turns used for the test condition. The results of these tests are plotted in graphic form in Figure 4 so as to relate grams load at the armature bushing to ampere turns for a large range of stroke values.

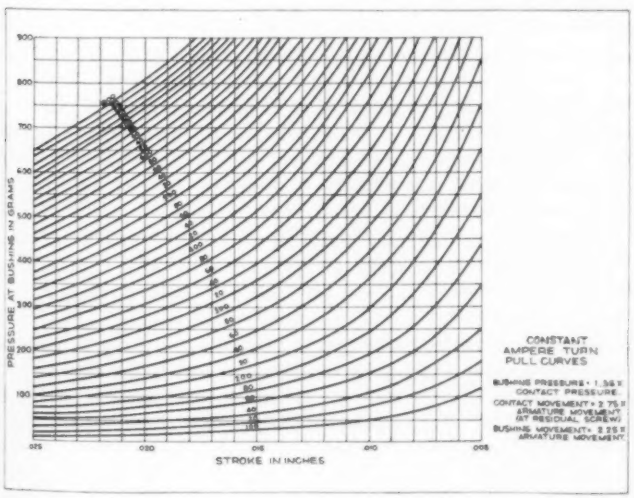


Figure 4

By referring to the table in Figure 2 or by using the data given in Article 2 for assemblies not included in Figure 2, the armature bushing load as the last break contact opens (or as the armature just leaves the back stop if there are no break contacts) may be determined for any assembly. This armature load value is used as the value of force in grams in referring to Figure 4 and the corresponding ampere turn value is found for the armature air gap used in calculating the bushing load and is used as the non-operate adjust value. The armature air gap is the sum of the gauging value specified for the last break contact (or stroke if there are no break contacts) and the specified residual air gap.

CHASE COUNTY REPLACES EQUIPMENT

To improve their service and increase the capacity of their central office equipment, the Chase County Telephone company, of Champion, Neb., recently installed a new Kellogg No. 50 magneto switchboard.

The new board is of the floor type with a low keyshelf. It is wired to its ultimate capacity of fifty lines, with ten cord circuits, an operator's circuit, and a night alarm circuit with control key. The board is equipped with a hand generator and switching key for power ringing.

This Kellogg board has 45 local line circuits, five line rural circuits, and a suspended type operator's transmitter. The equipment is housed in a beautifully finished cabinet of quartersawed oak.

The Chase County Telephone company operates in a rich agricultural district peopled by a progressive farming population. The new board has met with widespread approval because of its many features, including faster service and clearer transmission. The company is confident that the equipment will help them secure considerable new business because of the increased satisfaction and added customer good-will that the improved service is creating.

For the second successive month, following a steady loss for nearly a year, there has been a net gain in the number of St. Louis telephones.

FOR SALE

Magnetic Telephones, all makes, also parts for all makes. Also Leich late type Ringing interrupter, battery charging complete. Make offer in small or large quantities.

SCOTIA TELEPHONE CO.
St. Louis, Missouri

Kansans Urged to Maintain Normal Rates

Five Hundred Delegates Attend Thirty-first State Convention at Abilene; President Tucker Says Increased Taxes Make Rate Reductions Uneconomical; Congressman Strong and F. B. MacKinnon Among Honor Guests; C. L. Brown Is Host at Barbecue; A. T. Campbell Explains Noise Induction

Abilene, historic pioneer town of the Middle-West and generally conceded to be the present telephone capital of Kansas, entertained the Kansas Telephone Association for its thirty-first annual convention June 2, 3 and 4, with the United Telephone company of Kansas, which has its headquarters at Abilene, as host.

Convention headquarters were in the new Sunflower hotel.

President Tucker Discusses Rates

Convention meetings were presided

C. L. Brown, President, The United Companies, Abilene, Kansas.

over by Samuel Tucker of Pleasanton, president of the Kansas association, who dealt with the subjects of rate increases and taxation in his annual president's address.

Comparing telephone rates to the local Kansas situation, President Tucker reminded convention delegates that telephone rates had remained at their normal level when the price of wheat soared to $2 and $3.

"Our subscribers did not expect us to raise our rates to keep in step with the high prices of wheat," he said. "Yet now that the price of wheat has come down they are crying for lower telephone rates.

"It is important that we take account of the impression the public receives concerning the telephone company. We must remind them of our steadiness during high prices and educate them to understand why it is essential that our rates today remain at the normal level."

Advice against providing metallic lines at old ground line rates was given by President Tucker. He said it was uneconomical to attempt to give metallic service at old rates since by installing metallic lines the telephone company has a greater investment, increased taxation, maintenance which is at least doubled, and depreciation which increases proportionately with the above-mentioned increases.

He suggested that the company file metallic rates, making metallic service available to all subscribers who are willing to pay an additional rate for the superior service. In this manner, metallic service and increased rates are not forced upon anyone, but are offered, and provided only upon the request of the subscribers.

The first general session of the convention was opened with an address of welcome by Mayor Eli Hoffman of Abilene, followed by a response by G. W. Nimocks of the Scandia Telephone company. A. R. MacKinnon of Topeka, secretary of the association, read the annual secretary's report and brought out the fact that 160 companies operating 448 exchanges in Kansas are members of the state association and that these exchanges furnish nine-tenths of the telephone service for the entire state.

Metallic and Ground Return Lines

This was followed by an address, "Metallic versus Grounded Return Lines," by Harry N. Faris, technical engineer for the United Telephone company, Abilene. Mr. Faris discussed the relative advantages of metallic, ground return, and "mixed" lines. By "mixed" lines he referred to telephone companies which have both grounded return lines and metallic lines.

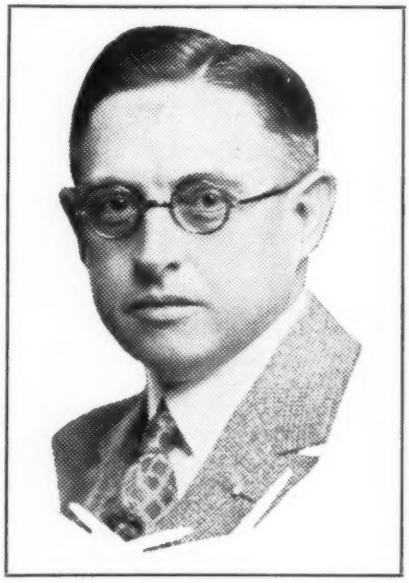
"Common battery rate orders specify metallic service and should never use grounded return lines," he said. "No company should be stampeded into attempting common battery service on lines that are not full metallic."

With magneto exchanges, high class ground return service can be returned with comparatively short lengths of entrance cable, according to Mr. Faris. However he said it became increasingly difficult to use ground lines satisfactorily as the exchanges became larger. He said a mixed line rarely afforded a satisfactory solution and only puts off the day when the issue must be faced, and urged that full metallic lines be provided as soon as grounded lines became impracticable for good telephone service.

Mr. Faris' address in full will be published in an early issue of TELEPHONE ENGINEER.

A lecture illustrated with moving pictures called "Preserving the Nation's Pine Poles" was presented by R. E. Meyers of the International Creosoting and Construction company, Galveston, Tex. Mr. Meyers' pictures showed the growth of the pine tree from a seedling to its full height, and also demonstrated how they were chopped down, cut into poles, treated with creosote to prevent rotting and termite attacks, shipped to points of distribution, and finally strung with wires and placed along the nation's highways.

Mr. Meyers' address was followed by



Fred Coulson, Vice-President, Kansas Telephone Association.

one entitled "Correct Posture," by Ben Williams, vice-president of the Do/More Chair Company, Elkhart, Ind.

In the evening of the first day of the convention delegates were guests of C. L. Brown, president of the United Telephone company, for a barbecue supper at Brown Memorial Park, south of Abilene.

Switchboard Salesmanship

The women's session the second day was presided over by Elliott Belden, publicity director for the United Telephone company, and addressed by D. C. Ballore, traffic superintendent, United Telephone company, and C. W. Motter, publicity director of the Lincoln Telephone and Telegraph company, Lincoln, Neb.

Mr. Ballore's subject was "Switchboard Salesmanship."

"There are more sales lost because of bad sales psychology than because of inferior merchandise," Mr. Ballore said.

"Every switchboard operator is a saleswoman," he said. "She must know human nature, know what to say and when to say it, and she must be able to accept criticism gracefully without ever giving it."

Campbell Gives Demonstration

The men's meeting was addressed by A. T. Campbell, transmission and protection engineer, Southwestern Bell Telephone company, Kansas City, Mo., who gave a lecture demonstration of "Noise Induction," and A. L. Stadermann, chief engineer, Citizens' Telephone company, Terre Haute, Ind., whose subject was "A National Switching Plan for Toll Service and the Transmission Requirements."

Mr. Campbell said there are two kinds of induction which cause noise, electric induction and magnetic induction. The former is a voltage charge from a power line to a telephone circuit. The magnetic induction is caused by the magnetic flux of a neighboring wire.

Mr. Campbell's lecture was illustrated by a miniature set of telephone and power lines and slides. He showed how grounded lines were far more susceptible than metallic to noise induction, when conditions of the power lines were identical in both cases.

The best method of reducing inductive interference, Mr. Campbell said, was through coordination by separation, which means keeping the telephone line at a sufficient distance from the power line to avoid induction. He advised separation for part of the line in instances where complete separation was not possible, and demonstrated that the amount of induction is in proportion to the length of exposure.

The other method of reducing induction is by transposition of the telephone line, the power line, or both lines. Mr. Campbell emphasized the importance of careful spacing of transpositions.

Forget Yesterday's Mistakes

During the general session the afternoon of the second day "Today's Talk" was discussed by Miss Anne Barnes, traveling chief operator, Iowa Independent Telephone Association, Des Moines, Ia.

"The only thing to do about yesterday's mistakes is to correct them if possible and then forget them," she said. "We keep our faces turned to the future and work for tomorrow."

Necessary qualifications of a telephone employe, according to Miss Barnes, are good health, high moral standards, unbiased mind, and a well-balanced mental attitude towards personal contacts.

"What Is This Personal Business?" was the subject of an enthusiastic talk delivered by L. C. Oberlies, personnel director, Lincoln Telephone and Telegraph company, Lincoln, Nebr.

"The warm milk of human kindness can iron out more wrinkles than cold cream," was one of Mr. Oberlies' statements and is typical of his entire address.

"Man power is as important as horse power, though we hear more about the latter," he said. "We have all been paying lots of attention to the machine; now it is time to look to the man who runs the machine."

"From the old attitude of 'the public be damned' we have graduated to 'the public be tolerated,' then 'the public be cultivated,' and recently to 'the public be made stockholders,' and 'the public be protected.'"

Importance of Outward Appearance

"The National Viewpoint of the Present Situation" was presented by the Hon. James G. Strong, congressman from Kansas, who himself is a pioneer telephone man, once having operated an exchange at Blue Rapids, Kans.

"I believe we are across the valley of depression and going up the slope," he said, "but it is a long way to the hilltop."

The history of state regulation of businesses was presented by L. D. Jennings, assistant professor of finance and public utilities, school of business, University of Kansas, in an address called "An "Academic Viewpoint of Public Utility Regulation."

In addition to the president's address, the last day of the convention was noteworthy for the addresses of Mark T. Caster, general plant superintendent, Lincold Telephone & Telegraph company, who spoke on "Plant Influence on Service Sales"; B. H. Smith, commercial superintendent, United Telephone company, who spoke of "Our April Income Increase, How We Did It, and The Results Obtained"; and the address by F. B. MacKinnon of Chicago, president of the United States Independent Telephone Association, on "Maintaining the Prestige of the Telephone Company."

The best way out of the present depression, according to Mr. Caster, is to assume that it will last for five or ten years, then forget it, concentrating on the development of plans for taking advantage of present opportunity.

Mr. Caster said telephone property is susceptible to the influence of outward appearance, which is often reflected in the condition and appearance of the plant. The physical plant must be well-designed and well maintained, he said.

The telephone industry has a threefold obligation, he said, first, to stockholders; second, to the public, and third, to the employes. Mr. Caster said the plant department was an important factor in discharging these obligations.

All attendance records for Kansas state conventions were broken at the meeting in Abilene. Nearly five hundred persons registered.

The same officers were elected to head the state association throughout 1931. They are Samuel Tucker, Pleasanton, president; Fred Coulson, Abilene, vice-president; T. L. Youmans, Osawatomie, second vice-president; V. E. Chaney, Kansas City, treasurer; Ranford Dunlap, Kansas City, assistant treasurer; and A. R. MacKinnon, Topeka, secretary.

Two additions to the executive board were made, increasing it from nine members to eleven. The new members are Walter Pedigo, Southwest Telephone company, Pratt; and R. R. Bunce, Kansas Telephone company, Topeka.

The old members are: R. B. Fegan, Junction City; C. J. York, Girard; C. A. Ulffers, Kansas City; Fred Coulson, Abilene; G. W. Nimocks, Scandia; J. A. Gustafson, Abilene; Foster Laming, Tonganoxie; H. J. Clark, Salina; and H. M. Cox, Kansas City.

GENERAL SURVEY CONDUCTED BY UNITED

Spectacular records were piled up by those working on the recent general survey made by five of the United Telephone companies. The Indiana companies, busy with reorganization and rebuilding lines, did not get into the survey this year. Those who were included and who completed their two-weeks survey with flying colors, included the United Telephone company of Kansas, the Central Kansas Telephone company, the American Telephone company, the Cumberland Valley Telephone company, and the United Telephone company of Missouri.

Operators, plant men, managers, installers, commercial men, stenographers, engineers, general superintendents and all the others went into action simultaneously on the first day of the campaign and by the end of the two weeks had called on nearly 100,000 subscribers and prospects.

As a result, 5,277 new telephones were connected, and 3,358 other sales were made, including grading up of service from wall telephones to desk sets and from desk telephones to hand sets. Included also in this number were joint user sales, additions to private switchboards and special wired features.

During this survey the telephone equipment of all persons interviewed was carefully inspected and literally thousands of cases of minor trouble were corrected and service thus improved.

The campaign resulted in an estimated increase in annual revenue of more than $100,000 for the five participating companies located in Kansas, Missouri, and Pennsylvania.

Barnhart Expounds Gospel of Good Service

Delegates to Indiana Convention Inspired by President's Annual Address and the Story of the Birth of the First Telephone as Told by Dr. Watson, Who Constructed It; Advantages of State Organizations and Conventions Cited by J. Warren Safford; Discuss Campaigns for Patronage

The story of the birth of the telephone was the feature of the convention program heard by Indiana telephone men attending the twelfth annual convention of the Indiana Independent Telephone Association at the Claypool hotel in Indianapolis Wednesday and Thursday, May 6th and 7th. The story was told by Dr. Thomas A. Watson, associate of the late Dr. Alexander Graham Bell, and the man who actually built the world's first telephone, in 1876.

He told how he and Dr. Bell, while working on a harmonic telegraph apparatus, stumbled by accident onto the means of producing the undulatory current which Dr. Bell believed necessary for the electrical transmission of speech. For a little less than a year Dr. Watson and Dr. Bell worked on the telephone instrument, correcting and perfecting it until finally, on March 10, 1876, a complete sentence was first spoken over a telephone wire. This sentence was spoken by Bell to his young assistant, Watson. It was: "Mr. Watson, come here; I want you."

Dr. Watson said the research begun by Dr. Bell and himself in working out the first successful telephone was still going on in the telephone industry.

President Barnhart Presides

Meetings were presided over by President Henry A. Barnhart of Rochester, Ind., who was re-elected for another term at the business meeting. In his annual address President Barnhart expounded the gospel of good telephone service and stable business. He said telephone property prospers most permanently on the good-will of its patrons and its community in general.

In listing the high-lights of his address President Barnhart mentioned the following:

In organization and convention there is strength and the fundamentals of uniformity in operation, accounting, rate making, maintenance, taxation and all that augurs for success by the process of standardization of our enterprise as a whole.

Good business can be built securely only on a foundation of high efficiency of plant and dependability and popularity of operation.

Encourage employes in progressive competency by giving them full knowledge of the industry by vocational instruction and convention opportunity, and reward merit with a showing of appreciation not only in words but in wages.

Practice of the Golden Rule in public relations and in dealings with connecting companies is a sure guide to success.

Enlarge business by going after it and do not invite office cobwebs by waiting for it to knock on our doors and ask to come in.

Take the public into our confidence as to the whys and wherefores of our business and fear not for all will be well.

If we have invested extravagantly in telephone property, it will be the part of wisdom and discretion to take low profits rather than invite violent rate fights that hurt for a long time.

And be open, fair and tactful in our fiscal and personal contact with the public, or the Congress or the legislature "will get us if we don't watch out."

Enlarging his statement of important topics for consideration by telephone men, President Barnhart said:

"Campaigns for increasing telephone patronage are being put on in many places throughout the country. Scarcely any two of these have been alike in plan of operation but they all have the same purpose—to increase patronage.

"All of these business builders have been more or less successful according to the organized effort and enthusiasm with which they have been conducted, and also depending somewhat on the severity of business adversity in the locality where the campaigns are conducted. However, success has been most pronounced where plant and operative efficiency are high grade and where judicious and liberal advertising has been done, the latter two requisites being especially helpful even if no soliciting campaign is put on.

"I wish to emphasize particularly the danger of paying excessive prices for telephone or any other utility property and then increasing rates to provide sufficient income to meet legal provisions for necessary expenses and interest on the investments. I say that such financing is hazardous, for that has been demonstrated in the serious trouble which has resulted in instances with which telephone managers in our state are familiar."

Why This Convention?

Another speaker whose address had an important place on the Indiana convention program was that of J. Warren Safford, president of the Troy Telephone company, Troy, O., and past president of the Ohio Independent Telephone Association. His subject was "Why This Convention?" and he discussed the many advantages of having telephone men gather at least once a year.

"If you expect to survive in the modern struggle for existence," Mr. Safford said, "you must continue to cooperate and to carry on as an organization. We must not be permitted to lose sight of the fact that by working together we can and do exercise a powerful influence for the progressive, consistent, continuous development of our own and each other's businesses.

"Taken by itself, the largest interest that is represented at this convention is just another corporation. If it happens to have a few brilliant individuals on its payroll, it may manage to carry on its operations in fairly good shape. When it comes to matters of national and statewide concern, however, that corporation is in danger every moment. Legislative and economic storms can cause it incalculable grief and expense, and cost its stockholders heavy loss.

"As a unit in a progressive, organized telephone group, however, every interest and every company in the entire telephone industry is in shape to devote its undivided attention to the operating end of the business, the earning of dividends and the improvement of service, only turning on the offensive or defensive when such organized effort becomes necessary.

"We are still a comparatively young industry. We have accomplished marvelous things in a short time. Throughout the history of the business we have maintained an organized front that has been and will continue to be our salvation."

An address on the adaptation of telephone directory advertising to the national advertising of trade-mark products was presented by C. B. Smythe, New York City, trade-mark service manager, American Telephone & Telegraph company.

"Business Office Methods" was thoroughly discussed by Mrs. Laura McClure of Argos. She stressed the importance of honesty, accuracy and thoroughness in the billing, collecting and keeping of accounts. She said protection against fire is required for the office records and advocated that only a small amount of cash should be kept on hand.

She advised telephone men against keeping their accounts in one bank, and suggested that checks be cashed promptly, keeping a record of the last endorser.

Transmission Important to Service

Good service and the influence of transmission upon it was discussed by T. DeWitt Talmage, transmission engineer, Illinois Telephone Association, Springfield, Ill.

He enumerated the three important factors of good service as: speed of connections; accuracy in making connections; ease and clearness of conversation. He enumerated the three important factors of transmission as volume, quality of received sound, and noise.

Cooperation and public relations within and without the industry were discussed by W. J. O'Connor, New York City, assistant to president, American Telephone & Telegraph company. He said the great driving force resulting in cooperation was exemplified in the slogan, "The Message Must Get Through."

He listed the following three requirements for production of a unified nationwide service: a certain measure of standardization of equipment; a definite measure of standardization in operating methods, born of routines; and conferences and discussions of our common problems such as the state conventions.

Farmer Is Good Telephone Prospect

An unusually interesting address was delivered by G. Don Sullivan, Huntington, editor of the Indiana Farmers Guide, on the subject, "The Farmer and His Telephone." He said the farmer is one factor which must be considered as most important. Present-day agriculture is different from that of years ago, he said. It is now a business and today the problem of farming is that of economic distribution.

The telephone and the truck are the keystones of the farmer's distribution, according to Mr. Sullivan, who said he must depend upon the telephone for his price quotations.

Mr. Sullivan discussed the farm telephone situation as a result of a survey of some 29 towns. He pointed out how the telephone affords protection for human life, lives of stock, and for personal property—and other uses for which it is almost invaluable.

One point not considered by telephone companies, he stated, is the market for extension sets on the farm. He mentioned as locations for extension sets the poultry house, dairy, and barns.

This convention was one of the most successful ever held in Indiana. There was a registered attendance of more than 525. An informal dance was held the night of May 6th, and the annual banquet, entertainment and dance the night of May 7th. Both were well attended.

The following directors were chosen at the business session: H. A. Barnhart, Rochester; F. E. Bohn, Fort Wayne; H. F. Farwell, Terre Haute; Sam Tomlinson, Plymouth, and F. M. Lantz, Monticello. Mr. Lantz is a new member of the board, the others being re-elected. J. G. H. Klingler of Brazil was elected to fill the unexpired term of Max F. Hosea.

Install New Switchboard in Liberal

Kellogg Company Provides Kansas Town With New Common Battery Switchboard and Rehabilitates Toll Board

By WM. C. STREHL
Rep., Kellogg Switchboard and Supply Co.

It was not so many years ago that Kansas was thought of as a prairie state with wide-open spaces. Today, thriving cities are springing up where but a few years ago only small villages were found. Especially is this true in western and southwestern Kansas. The Southwest Telephone company, with headquarters at Pratt, Kans., operates a number of exchanges in this southwest part of the state. Mr. Walter Pedigo, of Pratt, Kans., is president of the Southwest Telephone company.

Operating room, showing nine-position switchboard and chief operator's desk at Liberal, Kansas, exchange

Early in 1930 this company purchased the property of the Liberal Telephone company at Liberal, Kans. Shortly after this purchase was made the company completely remodeled and refinished the building. Adjoining the operating room is a comfortable rest room with davenport and rocking-chairs. The company is sincerely interested in its employees' well-being and operators are allowed two rest periods each day during which they make good use of the rest-room facilities provided. The very attractively refinished commercial office is presided over by Miss Mildred Gale, Miss Nellie Dowdy, and Mrs. A. Hoskinson, with Mrs. Harry Redford as chief operator.

After modernizing the building and enlarging its quarters the company's next move was to equip the exchange to take care of the heavy traffic, both local and toll, that has multiplied so rapidly in recent years. The growth of the business may be realized from the fact that whereas the company had seven toll lines in October, 1927, which at that time took care of all the traffic and rendered good service, today it has 23 busy toll lines, and more to be added. Practically all these toll lines get repeater service. This actually cuts the length of the line for a long haul to a comparatively short line, thereby improving conversation to a considerable degree.

The Kellogg company was called on to rehabilitate the toll board and install a new common battery switchboard with automatic listening and automatic ringing features. The operator with this board does not have to work a key to listen with, which gives her much more time to take care of answering calls. The board is also equipped with automatic peg counters, which enable the telephone company to determine at all times the traffic load.

Open house was held by the company on September 20th for the purpose of acquainting the subscribers with the problems and operation of the new telephone system. A hook-up was arranged in the operating room to show the visitors just how their calls go through to

give them the quickest and best service. The effect of flashing, once the connection has been made, was shown so the people were able to understand that this automatic feature would be broken and would have to be made over again.

Several hundred people who visited the exchange during the reception expressed their satisfaction with the new service they have been receiving since the cut-over, which took place several weeks ago. A register was provided for the visitors and the ladies were presented with carnations, and cigars were passed out to the men. The callers were very courteously received by the manager, Mr. R. R. Shives; Walter Pedigo of Pratt, president of the Southwest Telephone company; Earnest Hilliard, general plant superintendent; L. A. Helsel, general traffic superintendent, and Wm. C. Streh!, of Kellogg Switchboard & Supply company. Mr. Helsel was manager of the exchange here for a number of years before his recent promotion to general office at Pratt, and his Liberal friends were glad to greet him again.

The Kellogg company also furnished the new Warren Hotel at Liberal with a 200-line PBX switchboard as well as a 40-line PBX switchboard for the Rock Island depot. The PBX sales were secured by the telephone company and indicate how active the men in charge are, in going out and securing new business. The PBX sales not only give the hotel and railway depot a better, more satisfactory telephone service, but it also adds to the revenue of the telephone company.

The past growth and record of achievement that Mr. Pedigo and his associates have made for the Southwest Telephone company lead us to believe that in the next few years their success will prove to be even greater—and we, for one, wish them the best of luck.

IRISH FREE STATE PHONE SERVICE EXTENDED

The Irish Free State parliament has passed a bill authorizing the expenditure of a sum of $1,250,000 on the extension of the telephone service. Telephone facilities are to be provided in the remote rural districts, additional telephone kiosks are to be installed in a number of towns, and the automatic system of working is to be extended throughout Dublin and its suburbs.

CABLE ACROSS IOWA IS COMPLETED

The cable across Iowa, stretching 300 miles from Davenport, Iowa, to Omaha, Nebr., has been completed. This cable, which connected with the cable network of the Bell telephone system, is mostly aerial cable. It is practically storm-proof. It contains 556 wires of sixteen and nineteen gauge within its two and five-eighths inch diameter sheath. It provides six circuits for radio network. Along the route across the state are six repeater stations.

To give instantaneous warning when a break occurs in the cable, nitrogen gas under pressure has been put into the cable and this is indicated by an alarm when a break occurs. Periodic tests will also be made on the cable for insulation breaks.

CROSS-COUNTRY TELEPHONE BROADCAST

A cross-country telephone broadcast of "Good Will Among Men" was originated in Sacramento, Calif., May 18, as the featured "stunt" of a national Peace Day observance, under the auspices of the World Federation of Educational associations in co-operation with the National Council for Prevention of War.

A young woman member of the society spoke the words into a telephone in the office of the state superintendent of public instruction in Sacramento.

Her message was picked up in the capital of a neighboring state of California, where it in turn was relayed to the next state until it reached the headquarters in Washington, D. C.

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Trade in your old test set on a New STEWART with Detector coil. Tells distance and direction to line trouble. Complete as shown in sketch for $36.00. Sent on trial. Write for literature.

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Exide BATTERIES

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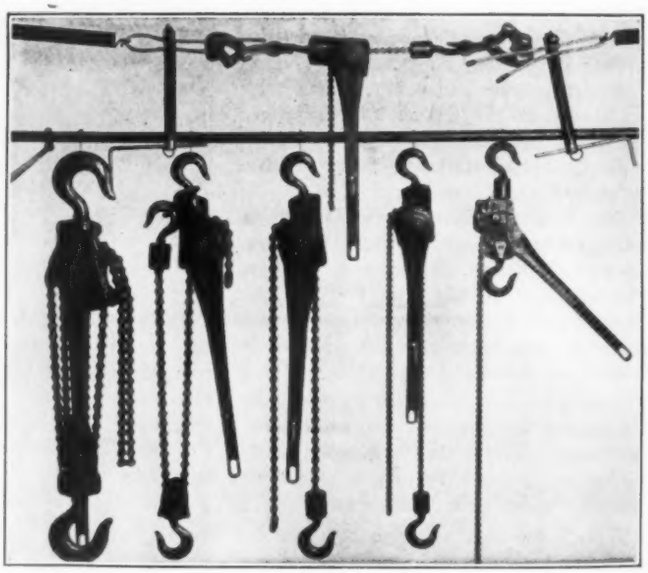
FAMILY GROUP



Model Z 6 Ton Weight 65 lbs.	Model F. S. 3 Ton Weight 36 lbs.	Model F. 1½ Ton Weight 25 lbs.	Model A. ¾ Ton Weight 13 lbs.	Model A Reversed

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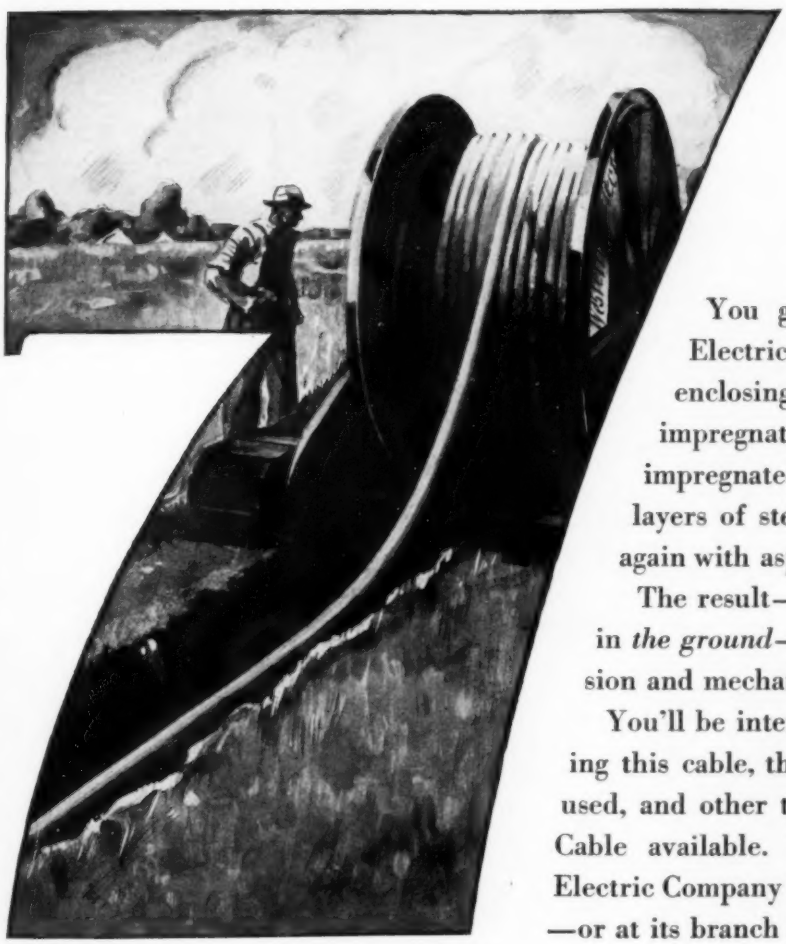

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The result—a cable you can safely *bury directly* in *the ground*—sure of its resistance to soil corrosion and mechanical damage.

You'll be interested in further information regarding this cable, the conditions under which it can be used, and other types of Western Electric Telephone Cable available. Write to the distributor, Graybar Electric Company in the Graybar Bldg., New York City —or at its branch nearest you.

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THE TECHNICAL CLEARING HOUSE

B. C. BURDEN, Editor

Cable Forms

Q.—What is the standard stitch which should be used for lacing up cable forms?

A.—Cable forms are laced up using a lock stitch as shown in figure 1. A

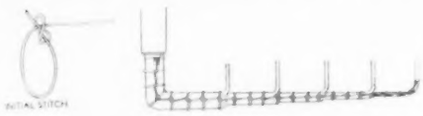


Fig. 1—Method of lacing up cable forms.

No. 12 waxed twine is used for this purpose.

Line Wire Soldering

Q.—What method do you recommend for soldering hand splices in old iron wire plant?

A.—If a large number of splices are to be soldered, as would be the case in overhauling rural lines, the following procedure and equipment is recommended. Using two light 16 foot or 20 foot ladders bolted together at the top, a prestolite gas soldering iron, and acid core solder, one man and helper can cover a large amount of line in a day. Spans which have more than three splices should be replaced with new wire. If wire is slack and ties in poor condition, it should be untied and soldered on the ground. A small wire brush should be used to brighten the joint. If the joint does not

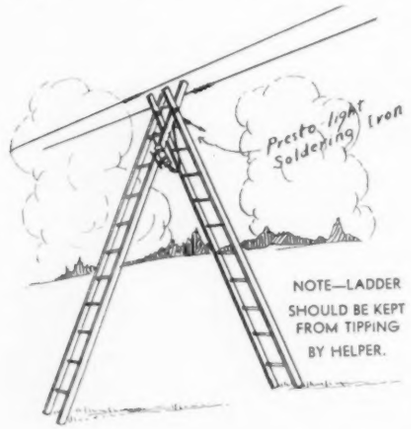


Fig. 2—Method of soldering line wire splices.

appear mechanically strong it should be cut out and sleeved. Solder should be flowed over the body of the joint. The ends of the wire which project through the sleeve should be wrapped around the line wire and soldered at each end. (Note.—This method should not be used on copper wire.) After a joint is soldered it should be wiped with a rag dipped in a saturated solution of "cow brand soda" to neutralize the acid flux left on the wire.

Figure 2 shows the method of soldering span splices without lowering the wire.

Cable Construction

Q.—How should cable sleeves be supported to the messenger?

A.—It was formerly the practice to use a marlin tie placed at the mid point of the sleeve, but standard practice now consists of using either a wire tie or a

Fig. 4—Wood moulding to prevent damage to cable sheath in trees.

special galvanized flat strap arranged as shown in figure 3.

Cable Protection from Trees

Q.—How should cable be protected when it passes through trees, to prevent damage to the sheath?

A.—Wood splints placed around the cable and held in place by wires around the splints, as shown in figure 4 will prevent the sheath from being damaged.

Local Battery Desk Set Circuit

Q.—What is the standard local battery

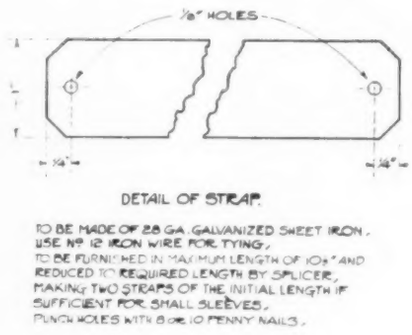

⅛" HOLES
DETAIL OF STRAP
TO BE MADE OF 28 GA. GALVANIZED SHEET IRON. USE No. 12 IRON WIRE FOR TYING. TO BE FURNISHED IN MAXIMUM LENGTH OF 10" AND REDUCED TO REQUIRED LENGTH BY SPLICER, MAKING TWO STRAPS OF THE INITIAL LENGTH IF SUFFICIENT FOR SMALL SLEEVES. PUNCH HOLES WITH 8 OR 10 PENNY NAILS.
Place strap over center of sleeve
STRAP IN POSITION

Fig. 3—Method of supporting cable sleeves.

desk set circuit?

A.—See figure 5.

Cone Type Receiver Caps

Q.—Is there any difference in receiving efficiency between the old style "flat type" receiver cap and the newer present day "cone type" caps?

A.—Yes, the cone type cap is much

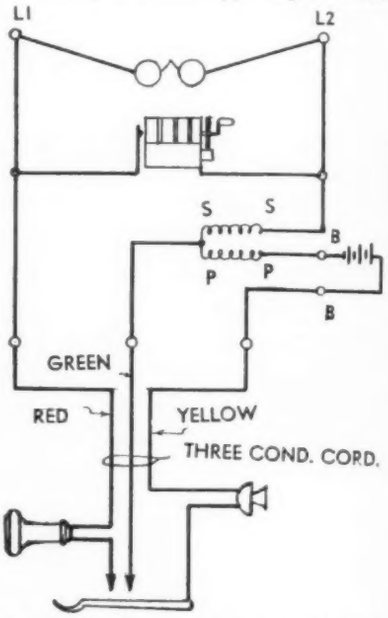
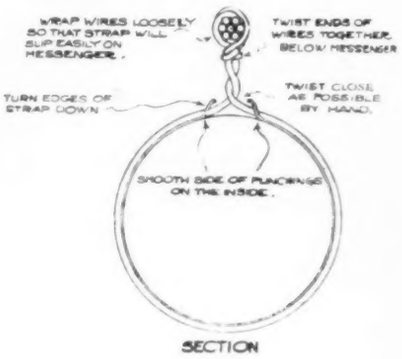


Fig. 5—Standard local battery desk set circuit.

more efficient and on long loops or heavy toll users stations only the cone type caps should be used.

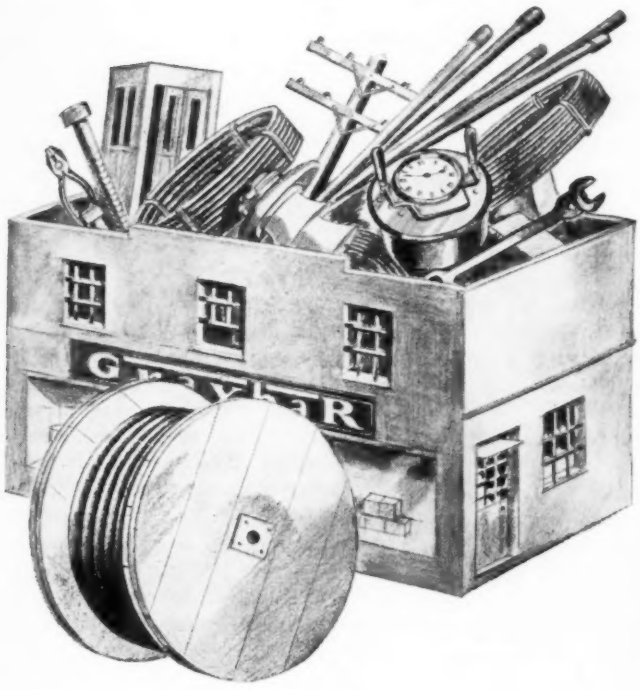

WRAP WIRES LOOSELY SO THAT STRAP WILL SLIP EASILY ON MESSENGER.
TWIST ENDS OF WIRES TOGETHER BELOW MESSENGER
TURN EDGES OF STRAP DOWN
TWIST CLOSE AS POSSIBLE BY HAND.
SMOOTH SIDE OF PUNCHINGS ON THE INSIDE.
SECTION

Receiver Air Gap

Q.—What is the best method of reducing an excessive air gap, or uneven dia-

(*Continued on page 42.*)

for every telephone need



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(Write for booklet)

Discuss Methods of Increasing Revenues

Ways and Means of Stabilizing Telephone Business Through Campaigns Popular Subject for Discussion at Convention of Up-State Telephone Ass'n of New York; Ihmsen Re-elected President; Thos. H. Laine, New York Telephone Co., and Mark Graves, State Tax Commissioner, Speakers

Possibilities of increasing and stabilizing telephone business through adequate personal relations and business drives for additional subscribers proved to be the key-note of the annual convention and operators' conference of the Up-State Telephone Association of New York held at the Seneca Hotel, Rochester, May 20 and 21.

J. G. Ihmsen of Albany, president and general manager of the Up-State association, gave the annual report of association activities. According to President Ihmsen, the telephone industry has been affected by the general business depression, but not to the extent of other businesses and industries.

He said that in the last five years rapid progress has been made in the telephone industry, with the large companies in cities having the larger increases in revenues. Now, however, he stated, the telephone companies operating in smaller communities are having less difficulty in holding their subscribers than those in larger places.

President Ihmsen said that until recently small telephone properties did not fully appreciate the significance of the word "transmission" as applied to message circuits and did not understand the importance of good transmission. Their judgment of quality was founded upon local requirements and the broader aspect of toll transmission was never considered, he said.

This condition is being largely remedied through state and district conventions, and through the close cooperation of the Up-State association with the connecting department of the New York Telephone company, President Ihmsen said.

People Changing Their Habits

F. B. MacKinnon of Chicago, president of the United States Independent Telephone Association, addressed the delegates on "Maintaining the Prestige of the Telephone Company."

He expressed optimism for what he calls "this present period of adjustment" and indicated that the habits of the American people are undergoing a sort of revolution, or evolution.

He said the depression was not brought on entirely by the gambling orgy of 1928 and 1929, but also by the changing habits of the people. To illustrate this point the speaker reminded his audience that the railroads in 1928 did not haul any more freight than in 1920. Prior to 1920 the amount of freight had doubled every ten years. This, President MacKinnon said, was due to a shift in the habits of the people who are now shipping freight by motor truck, while busses are competing with railroads for passenger traffic.

Other changes mentioned included the eating habits of the people, which are shifting from wheat, potatoes and meat to various vegetables; changes in merchandising including modern packing methods and mechanical refrigeration; and the trend to electrical methods in place of chimes and carillon.

But he pointed out that the telegraph has not supplanted the telephone. On the contrary he said the telephone has supplanted the telegraph.

"This being the base, should not the telephone industry be moving forward, strengthening its lines at every point, and maintaining its position of supremacy as the suppliers to the people of the means of communication which they so evidently demand, and which, in this period of adjustment, is really needed more than ever?" he asked.

"The present difficult times call for every man to exert his very best efforts and call upon him for vision, enthusiasm and initiative," he stated in closing.

According to R. A. Lumkin, president of the Illinois Telephone Association, a speaker at the New York convention, depressions have much the same effect on men that operations have on women—they enjoy talking about them.

"And it is time to stop talking," he said. "Business is what people make it. The basis of prosperity is laid in a period of depression. There is business to be had now, and there is increased remuneration to be reaped when we turn the corner. It seems to me that telephone companies have been social minded long enough. It is now time to become sales minded."

Discuss Campaigns for Business

Following Mr. Lumkin's address, President MacKinnon, who presided at this session, stated that district campaigns for increased business can be put on just as by a single company, and that the various companies in the districts can be pitted against each other in competition for an increase in their revenues. He declared this the most feasible plan known of bringing to employes the plan of selling and creating enthusiasm through the competitive spirit.

In the discussion which followed these remarks, Frank T. Byrne, commercial superintendent, Rochester Telephone corporation, referred to campaigns by his organization and declared that "atmosphere" must be created among employes to sell telephone service. They must be instilled with the belief that there is no reason for opposition to telephone service sales, he said.

L. E. Barnett of Savannah said that for the past two years he had been engaged in rebuilding his telephone plant. His toll business increased 12 per cent last year, and there has been an increase of about four per cent in subscribers without any definite campaign. It is his belief that this increased business is due entirely to the rebuilding of the plant.

A continuous sales program was advocated by Gustav Hirsch of Columbus, Ohio, who stated he believed in a sales organization for the definite purpose of going out after more business. He urged an inspection of the subscriber's equipment and its repair, and a selling campaign at the same time.

R. Philip Hart of Cazenovia reminded delegates of the field for increased business in rural schools. He said he had recently sold service to 16 schools in rural territory.

"Forestry and Tree Trimming" was the title of the opening address the second day of the convention, delivered by John E. Keib, forester, Niagara-Hudson Power corporation, Watertown.

Fifteen years ago telephone and light companies did not pay much attention to trimming trees, he said. Now, however, he said companies trim trees properly. He outlined methods used by his company which trims trees on both sides of the streets, thus balancing them.

Must Educate Rural Subscribers

R. H. Burfeind of Chicago, sales engineer of Automatic Electric, Inc., then spoke on "Economics of the Small Rural Exchange." He emphasized the need of a sales organization in the telephone business especially to educate rural subscribers to the necessity for higher rates, in order to enable the telephone companies to provide better service.

"Today's Switchboard and Tomorrow's Profit" was the subject of an address by R. B. Miles of Chicago, sales engineer, Kellogg Switchboard & Supply company. The five elements of telephone service in which subscribers are interested, he said, are: a quick answer, a

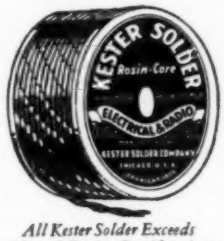
"Trouble Shooting

was costing us plenty—

Then we heard about Kester!"

"The maintenance costs in locating high resistance joints were knocking the daylights out of our profits. And that's not taking into consideration the customer good-will we lost. Then we got next to ourselves and began soldering. Next, we learned about Kester—and cut *soldering costs!* And man, the results were almost unbelievable!"

Kester does make a difference! Ask Plant Supervisors of large or small telephone companies from coast to coast. They'll tell you that when Kester comes into the picture—defective connections fade out of it *fast*. Only the purest virgin metals are in Kester Solder—and the self-contained flux is scientifically designed to prepare the surface for a perfect bond. Kester is speedy, too—cuts soldering time down by a third. There's Kester Rosin-Core Solder for delicate switch-board wiring, and Kester Acid-Core Solder for all the heavier work. Your telephone supply house sells both of them on 1, 5 or 20 pound spools. Get next to Kester right now! Write to our Industrial Development Department! Give the necessary information and we'll produce a flux-core solder exactly right for your own specific needs.



All Kester Solder Exceeds Class A Purity Specifications of the A. S. T. M.

Kester Solder Company, 4218 Wrightwood Avenue, Chicago, Ill. Incorporated 1899.

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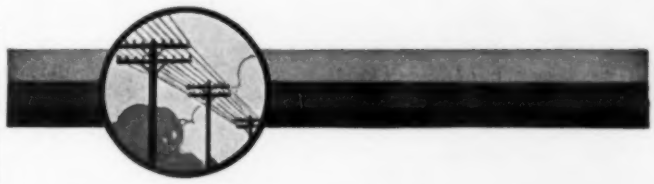
FLUX-CORE
SOLDER
Acid-Core · Paste-Core · Rosin-Core



AN ORGANIZATION OF EXPERTS

IN the manufacture of any product, there are invariably certain things relating to design, to the quality and relative proportions of component materials, to the various processes of practical fabrication—which can be learned only by experience.

The manufacture of wires and cables is no exception. For telephone cables, for magnet wire, for power conductors—uniform conductivity, proper tensile strength and unfailing, durable insulation are of the highest importance.

For such products, experience is a prime requisite. For forty years this company has been in the business of manufacturing wires and cables—of every kind and for every purpose. Our employees are experts, trained to value quality above all else. As a result, the name Phillips has become a synonym for excellence, a guarantee of durability and quality. We will be glad to submit prices and specifications upon request.

We are manufacturers of—

Bare and Insulated Copper Wires—Rubber Insulated Wires—Enameled Wire—Magnet Wire—Power Cables—Switchboard Cables—Paper Insulated Cables—Flexible Cords—Electrolytic Copper Rods, Shapes, etc.

EUGENE F. PHILLIPS ELECTRICAL WORKS, LTD.

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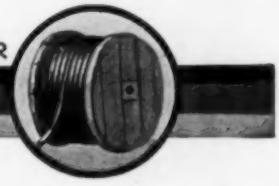
MONTREAL AND BROCKVILLE
BRANCHES
WINNIPEG, REGINA AND VANCOUVER



speedy connection, a satisfactory conversation, a rapid disconnect, and a prompt recall.

The essential part played by employes in the creation of good and understandable relations between the public and public utility corporations was stressed by Thomas H. Laine, assistant vice-president of the New York Telephone company. He spoke on "Public and Personal Relations of the Telephone Industry."

"It is certain that public relations are primarily a matter of reputation with the public, and that such reputation is largely created by employes," he said. "Therefore, at all times employes should be informed of the policies that animate the industry. In addition, their daily work will bring them into contact with improvements and betterments resulting from such policies, so that they will have a clear understanding of their company."

Mr. Laine contended that an enthusiasm on the part of the employe for his industry and his employer is essential to good public relations, and he said that this enthusiasm could only be created and maintained when the employes were satisfied with their jobs and felt secure in them.

Considering the Tax Problem

In an address on "Possibilities for Economy in State and Local Government; What About the Future?" Mark Graves, state tax commissioner, said that "eternal vigilance in watching expenditures and proposed expenditures and the awakening of a tax consciousness in the mind of the body politic is the price we must pay if taxes are to be kept from mounting unreasonably."

If the nation and state continue to grow in population, as, he said, they will, Mr. Graves predicted that taxes in the aggregate would continue to grow. "If," he added, "we can keep the increase within reasonable bounds, say four to four and one-half per cent, yearly, as was the case between 1880 and 1910, we should consider ourselves fortunate."

Leo K. Farnan, plant methods supervisor of the Rochester Telephone corporation, spoke on "Service Responsibilities of the Plant Man," and Ben Woodbury, telephone sales manager of the Stromberg-Carlson Manufacturing company, spoke on "The Telephone Manufacturer."

President Ihmsen was re-elected to head the association for another year at the annual business meeting; H. H. Griswold of Phelps was named secretary; Charles M. Beattie, Rochester, treasurer; and F. J. Brookman of Rochester, assistant secretary.

Directors elected are: J. P. Boylan, Rochester; B. H. Brooks, Plattsburgh; V. E. Code, Gloversville; F. D. Fancher, Middletown; H. W. Fluhrer, Oneonta; H. H. Griswold, Phelps; J. G. Ihmsen, Albany; L. H. Jenks, Carthage; H. P. McDonough, Newark; F. C. Saunders, Willsville; W. A. Selly, Norwich; and J. H. Wright, Jamestown.

TYLER, TEX. WILL IMPROVE SYSTEM

A total expenditure of approximately $250,000 has been authorized to provide necessary facilities in both local and long distance telephoning in Tyler, Tex., according to J. P. Williford, district manager in Tyler.

FROM MAGNETO TO FULL COMMON BATTERY

The telephone exchange at Washington, Mo., owned by the Scotia Telephone company, was cut over from Magneto to full common battery on May 15th. This exchange owned about 900 city stations and over 200 rural stations. Prior to the cut, nearly 40 per cent of the stations were four party lines, but in the new system, there are only two party selective lines. Thus, nearly 300 directory changes were necessary and a new directory was issued simultaneously with the cut-over. The equipment was built by the Stromberg-Carlson Telephone company.

THE TECHNICAL CLEARING HOUSE

(*Continued from page* 38.)

phragm seat on a telephone receiver?

A.—This can best be done by giving the brass diaphragm seat several rotary strokes on a sheet of number 0 sand or emery paper which is placed on a perfectly flat surface.

Disc Type Anchors

Q.—We have been using old discs purchased from farmers as anchoring plates. What is the best way of placing this type of anchor?

A.—There are two methods commonly used for placing disc type anchors. Method No. 1 is to dig a straight hole big enough to house the disc and then slot the side of the hole so that the rod will lay at the proper angle. Method No. 2 is considerably better and consists in digging a hole slanting in the opposite direction from the down guy and then driving a rod through the undisturbed earth so that it penetrates the anchor hole near the bottom. The disc can be slipped on and the nut held in place with a special wrench while the rod is turned to run in on it. This method is identical with the method in placing anchors of the "nevercreep" type. The discs should be painted with heavy asphalt paint to prevent rusting. It is highly important that the rounded side of the disc be placed so as to act as the bearing surface, otherwise the sharp edges of the disc will cut into the earth causing the anchor to slack off.

Impedance of Magneto Telephones

Q.—What is the impedance at 1000 cycles of the average magneto telephone?

A.—The approximate impedence is around 700 ohms at 1000 cycles. This value is somewhat lower where a nonring through condenser is used in the receiver circuit.

Transmitter Adjustment

Q.—What is the correct adjustment for the tension on a transmitter carbon cup?

A.—The set screw which holds the carbon cup stud in the bridge should be loosened and the cup allowed to assume a normal position after which the set screw should be tightened so as to lock the cup in this position. The front electrode should not be under tension.

PROPOSE WIRELESS TELEPHONY BETWEEN INDIA AND CEYLON

In connection with the discussions relative to the development of long distance telephone service in India, one of the first trunk lines suggested was one connecting Madras with Colombo, and in furtherance of this scheme the Indian Posts and Telegraph Department has suggested to the Postmaster General of Ceylon that the two Departments cooperate in the reformation of the existing land lines and in the laying of a submarine cable between Dhanushkodi, on the Indian side, and Talaimannar on the Ceylon side of the Gulf of Mannar. In view of certain local difficulties to be anticipated in the successful maintenance of service over the proposed line, and of the cost of laying the Mannar cable, the Postmaster General has made the counter suggestion that wireless telephony be tried under the joint direction of the Indian and Ceylonese Departments, the results of the suggested trials to be used as a basis for the installation of a permanent service.

The Indian Posts and Telegraph Department has agreed to participate in the proposed trials, and the Department's Director of Wireless has addressed the Standing Finance Committee of the Legislature on the subject, but before a definite decision can be arrived at the Committee requires further data on the project, the total cost of which is estimated at 7,000 rupees ($2,555), divided as follows: Cost of apparatus, 3,000 rupees ($1,095); pay of temporary establishment, 2,520 rupees ($920); and traveling allowance and contingencies, 1,480 rupees ($540). Assuming that the Committee sanction the expenditure in the 1931-32 Indian budget, another forward step will have been taken in the modernization of the country's means of communication.

The Service-Hour Cost is *Less*

YOU BUY telephone batteries for just one purpose—to give satisfactory service for a long time. Short service means high cost—long service, low cost. Ray-O-Vac Telephone Batteries cost less because they deliver more service—many hours more than other cells. This is proved not only by competitive tests conducted in accordance with U. S. Government standards, but by users' records as well. Moreover, there's an appreciable saving in service costs. Standardize on the Ray-O-Vac Telephone Battery—the cell with the low service-hour cost.

FRENCH BATTERY COMPANY
Madison, Wisconsin
General Sales Offices:
20 North Wacker Drive, Chicago, Illinois
Makers also of Flashlight Batteries, Rotomatic and Standard Flashlights and Electric Lanterns

RAY-O-VAC

Keeping an Eye on Millions of Dollars

THINK of the vast sums which have been collected on toll charges since 1894, when the first Calculagraph to serve American telephone companies began its work of counting up the minutes and excess minutes on the nation's toll boards. What a keen, watchful eye the Calculagraph must have kept on these millions of dollars, to serve so long and with such complete satisfaction.

The Calculagraph stamps on the toll ticket the beginning of each call together with the time elapsing during each call, down to the quarter of a minute, for any number of calls—producing a permanent and accurate record of each.

Prices and Information on Request.

THE CALCULAGRAPH COMPANY
50 Church Street Dept. 22 New York City

CALCULAGRAPH
THE ELAPSED TIME RECORDER

MEETING SPECIFICATIONS *with a* MARGIN

Taking borings to determine preservative penetration

Rejections take time—may cause delay. Avoid trouble by ordering National Lumber and Creosoting Company Poles. Made of strong Southern Yellow Pine, Pressure Treated for years of enduring service. You can depend on these longer lived poles to meet your specifications with a margin.

National Lumber & Creosoting Company

GENERAL OFFICES: TEXARKANA, ARK.-TEX.

SALES OFFICES
Texarkana, Ark. Houston, Tex.
Kansas City, Missouri
St. Louis, Mo. Denver, Colo. Superior, Wis.

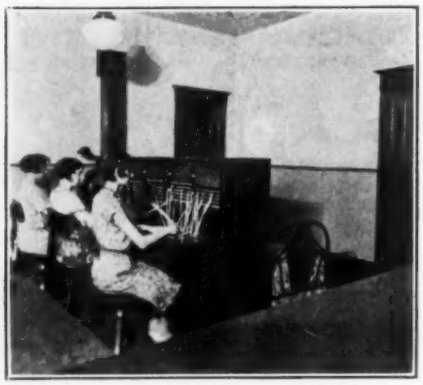
TREATING PLANTS
Texarkana, Tex. Houston, Tex. Alexandria, La.
Finney (P. O. Col. Park, O) Kansas City, Mo.
Salida, Colo. Denver, Colo. Superior, Wis.

Stromberg-Carlson in Oak Harbor, Michigan

Northern Ohio Telephone Company Installs Junior Multiple Switchboard—Cut in Service Early in 1930; Results in Increased Business for Company

By J. C. SNYDER
Sales Engineer, Stromberg-Carlson Telephone Mfg. Co.

One of the most enterprising towns in northern Ohio is that of Oak Harbor. It is located on the Portage river a few miles distant from Lake Erie, 25 miles west of Toledo and in the heart of the noted fruit section of that state. This progressive town of 2,000 inhabitants boasts of a live business men's associa-



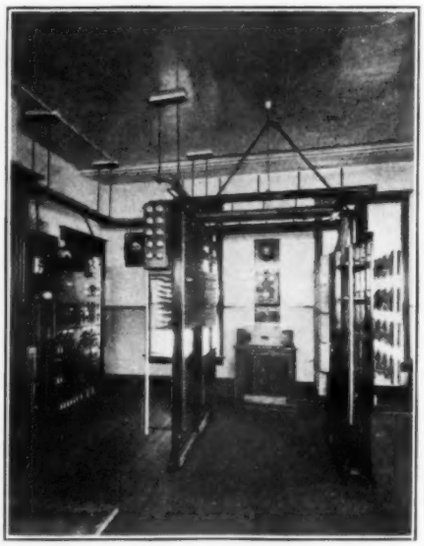
Stromberg-Carlson junior multiple switchboard in operation in the Oak Harbor exchange of the Northern Ohio Telephone Company.

tion, Lion's Club, finest schools in the state for town of its size, five churches, two banks with over a million dollars each on deposit, numerous factories, public library, electric light, power and pure water systems, fine homes, paved streets and splendid transportation facilities of two steam lines and an electric line, as well as main highways.

This town is situated in the very center of Ottawa county and is surrounded by the richest agricultural and horticultural lands in the country. It received its name from a harbor on the limpid Portage river which afforded shelter to the ships that carried lumber from its docks to ports on the Great Lakes. With its rich soil naturally fruit, vegetables, sugar beets and dairy industries thrive as well as the poultry industry.

In such a community the telephone plays and has played a wonderful part in the life of the town. Like in many other towns in the early days of telephony, the pioneer work was initiated by a physician, perhaps because of his need for a quick method of communication. The original telephone company of Oak Harbor was organized by Dr. F. W. Gradolph, who was interested in its development for a number of years. In 1902 the New Ottawa County Telephone company was organized with Emery Thierwethter as president and the late J. G. Steinkamp as manager. Under their direction the telephone business grew and became a prominent factor in the growth of the town. During the year 1926 the plant was sold to Frank A. Knapp of Bellevue, and in April of 1927 it became a part of the organization now known as the Northern Ohio Telephone company with main offices in Bellevue, Ohio, and ably managed by William C. Henry.

Under the latter management the entire outside plant was rebuilt and brought up to date. The old magneto switchboard had outlived its usefulness and in 1929 the company made a study in regard to requirements for new switchboard equipment. It was finally decided that a universal switchboard would be best adapted for this particular installation. This presented an engineering problem because the switchboard had to



View showing power board, relay rack and main frame in the Oak Harbor exchange of the Northern Ohio Telephone Company.

be of the lamp signal multiple type with lines arranged to take care of the present magneto telephones and central energy telephones. The ringing system on the magneto telephones was four-party pulsating and harmonic ringing was desired for the new central energy telephones. It was planned to make the change in telephones gradually, and it was necessary that both ringing systems be maintained until the entire change was made. In addition it was desired to have the switchboard arranged so that modern features could readily be added at a later date, with little expense and interruption to service. The features were to include machine ringing, reverting

Telephone building at Oak Harbor, owned by the Northern Ohio Telephone Company.

ringing tone, flash recall and secret listening.

After making a careful survey it was finally decided to purchase a junior multiple switchboard as manufactured by the Stromberg-Carlson Telephone Mfg. company. This new switchboard was installed in the early part of 1930 and during the short time it has been in service it has given the most efficient telephone service to the community, with a substantial saving in operating cost. The new switchboard will handle greater operator loads with greater speed and less fatigue to the operator.

The number of local lines equipped on the new switchboard is 280. There also are 60 rural and 10 toll lines. The present number of subscribers is approximately 735, which is a good average development for a population of 2,000. The officials of the Northern Ohio Telephone company have spared no expense in improvements on either the outside or inside plant to make its service the most efficient. This policy has resulted in a big increase in business since the equipment has been installed, showing that the community does appreciate up-to-date service.

In the well arranged terminal room we

(*Continued on page* 54.)

"Two years of the roughest use possible—

—and still in the running!"

Ray Blain, Telephone Plant Engineer, Signal Corps, U. S. Army, Fort Hayes, Columbus, Ohio, is an authority on tool design and standard tool practice. The accompanying photograph together with a testimonial letter, came to us unsolicited—enthusiastic tribute to the remarkable durability of Vacuum Grip Lineman Pliers. We quote in part from his letter:

"THESE pliers have been subjected for *two years* to the roughest use possible—just to determine what they would stand.

"They have been used to hammer in lag screws, a purpose never intended for any pliers. They are considerably battered, but the rivet has not tightened, the jaws still operate freely and the cutting edges are still in line. Many a steel 'messenger' has been nicked with them so that it could be broken later—another use never intended for ordinary pliers. Despite all this rough usage this pair of Vacuum Grips is *still in the running*, has excellent cutting edges and will cut large sizes of copper wire clean, so that it enters the splicing sleeves without difficulty.

"This two years of rough usage would be equivalent to *at least* 15 *years of ordinary pliers' use!* I consider it truly remarkable that a pair of pliers can be made so well that it will withstand such an extended period of abuse."

PURCHASING AGENTS: Durability such as is described above spells big economy for the companies using Vacuum Grip Professional Lineman Pliers. Made in three sizes: No. 58—8½". No. 57—7". No. 56—6". Company or lineman's name etched Free on handle of each pair...Write today for prices and then order a few pairs for your men to use in running tests.

FORGED STEEL PRODUCTS CO.
Newport, Pa.

Vacuum Grip REG. U.S. PAT. OFF. **Pliers**

Built *UP* to a Standard—Not *DOWN* to a Price

NEARLY A MILLION IN USE

What's a little Rough weather to COPPERWELD DROP WIRE?

Storms — snow — heat — cold—sleet—high winds . . . !

Copperweld defies them all. With a strength greater than either steel or copper alone this twisted pair drop wire is built to defy weather. And its quality insulation—applied to Graybar specifications—still more increases its resistance to the elements.

Telephone engineers can always be safe in specifying Copperweld—a wire stronger than the weather.

GraybaR

Distributed by GRAYBAR

Offices in 76 principal cities

Requirements of Modern Telephone Traffic

Telephone Industry Destined to Head List of National Communication Agencies, According to J. P. Boylan, Who Discusses Rochester, New York, as the Typical City in This Article, Originally Delivered as an Address Before the Rochester Engineering Society

In the telephone business, as in any other business, the telephone corporation plans its future principally on the record of past performance. The traffic department of a telephone corporation is concerned mainly with three general aspects of the business, namely, to increase the efficiency of the service, to assist in bringing about economy in operation, and to furnish the chief engineer with the necessary data to provide additional equipment for growth—far into the future.

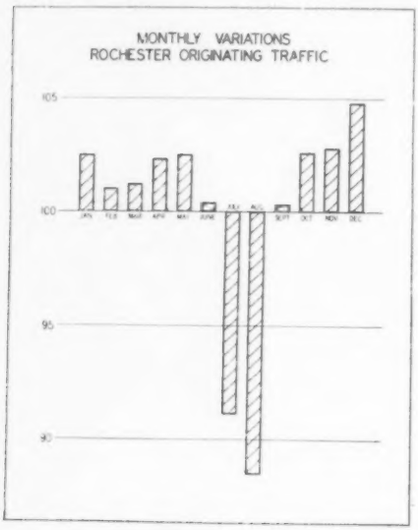


Chart No. 1

The first two items sound rather paradoxical, yet the history of our company over the past ten years has proven that it is possible to greatly increase the efficiency of the service and at the same time effect marked economy in operation. For example, the item of operators' wages per 1,000 calls handled in 1922 was $6.50, and, notwithstanding an increase in the wage level, the traffic cost of handling 1,000 calls steadily decreased until it reached $4.40 for 1930, a reduction of 32.3 per cent.

Recent Economies in Operation

Again, the traffic cost per telephone was reduced from $17.50 per annum in 1922 to $11.25 in 1930, a decrease of 35.7 per cent. Upwards of 80,000 tests and observations of the telephone service in Rochester were made during the past ten years and the general summary shows that the average time for the operator to answer was 3.6 seconds, and the average time to disconnect was 3.7 seconds.

Generally speaking, the greatest economy in operation has been brought about by our engineers in collaboration with the engineers of the Stromberg-Carlson Telephone Manufacturing company, adding the super-service features which made our switchboards over 30 per cent more efficient than they were originally. This 30 per cent figure is substantiated by the percentage decrease in traffic costs previously quoted.

The total originating calls on the average business day in the city of Rochester is 422,263. There are two busy seasons for local traffic, viz., the spring—April, May and June, and the fall—October, November and December. The high month for the average business day calls is June, with 454,000, and the low month is August, with 373,000. The heaviest traffic is mostly experienced on days preceding and following holidays, averaging 20 per cent higher than the average for the year, or 506,000. Three days just preceding Christmas, the calls averaged 545,000 per day. The two busy seasons for long distance calls differ considerably from the busy season for local traffic. They are the summer months of June, July and August, and the fall months of September, October and November. The average daily L. D. calls for these months are 4,100. The high month for L. D. business is November; the high day being 4,245, and the low month is December, the low day being 3,525.

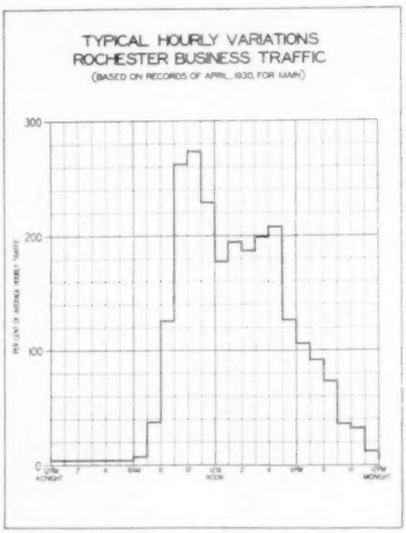


Chart No. 2

Charts Show Load Distribution

The number of switchboard positions required to handle Rochester telephone traffic are: "A" board, 310; "B" board, 79; long distance, 72; information, 12; intercepting and miscellaneous, 24, a total of 497.

Chart 1 indicates typical seasonal fluctuations of Rochester city traffic, based on the experience since 1922 and shows that June is not ordinarily a high month, although it so happened in 1930.

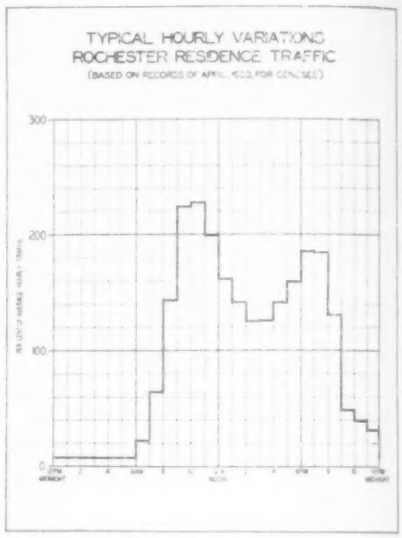


Chart No. 3

Chart 2 shows the distribution of the day's load by hours in main exchange, the great bulk of the traffic being from business telephones. It is characterized by great concentration and a high peak.

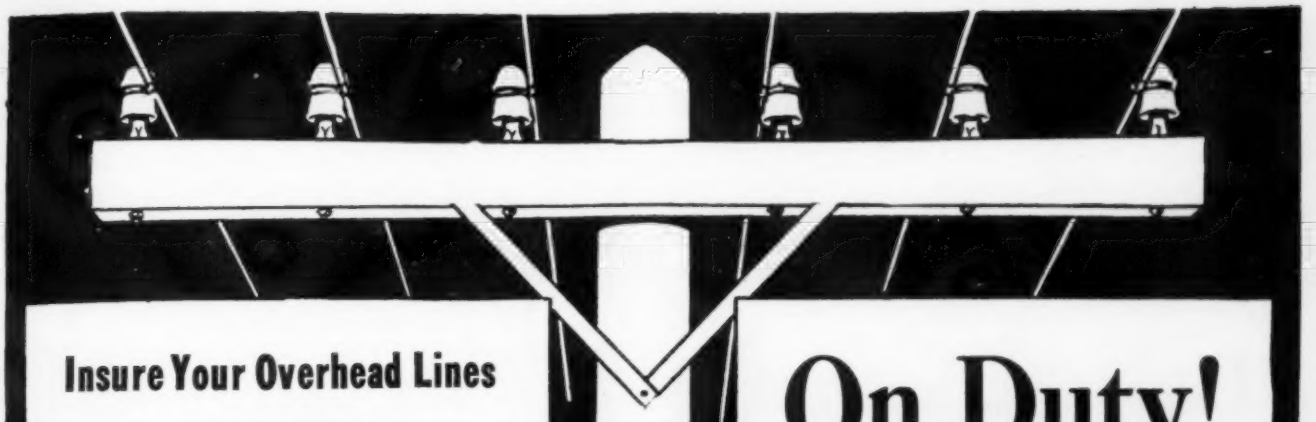
Chart 3 shows a similar distribution of the day's load by hours, in Genesee, selected as typical of the traffic in central offices which serve principally residence telephones. The distribution of the traffic is rather more regular; the peak is not so high and there is a secondary peak in the early evening hours.

On both charts 2 and 3 the actual hourly traffic is shown in terms of the average hourly rate.

In the language of the electrical engineer, the load factor of the residence exchanges is higher than that of the business exchanges. In terms of the busy hour loads shown on charts 2 and 3, the load factor for Main is 36.6 per cent and for Genesee, 44.0 per cent.

The distribution of the traffic in selected periods for these two offices is shown and compared on chart 4.

Although not directly shown, it is interesting to note the effect of the secondary evening peak shown on chart 3 for Genesee. In the three-hour period from 6 p. m. to 9 p. m. Genesee handles 20.9 per cent of its day's traffic, while in the same period Main handles only 11.3 per cent of its day's load—about the



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BY SPECIFYING

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NORTHERN or WESTERN

CEDAR POLES

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Prompt Shipment from Minneapolis Yard.

T. M. Partridge Lumber Co.

Minneapolis, Minn.

On Duty!

--since the turn of the Century

NORTHERN White Cedar Poles are long-lived. A great number of them have been rendering reliable service since the latter part of the nineteenth century. They have served through long years without decay; they have stood fast in all kinds of soil; they have the necessary stamina to hold up when the wind and sleet tugs at their crossarms.

Northern White Cedar Poles have the ideal taper that guarantees firm anchorage in all types of ground (one inch to every five feet), they have large, firm butts that give great strength at the groundline, they are endowed with a high resistance to decay.

Northern White Cedar Ass'n

Minneapolis Minnesota

Northern White Cedar Poles

same in volume as its "busy hour" load.

The concentration of the load in business offices suggests one of the reasons why the charges for business service are higher than for residence service. Central office equipment and buildings to house

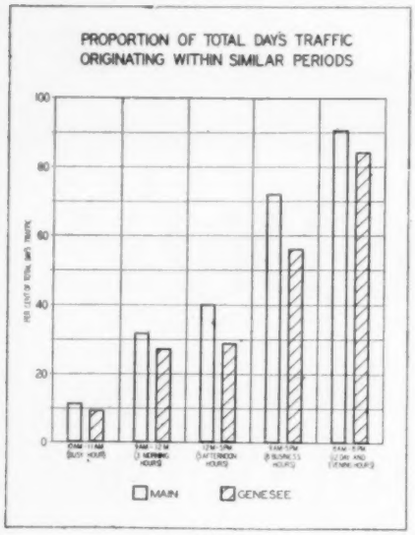


Chart No. 4

it, and inter-office trunks must be designed to handle busy hour loads. The greater the concentration of traffic, the smaller the percentage of 24-hour possible use.

This lack of 24-hour use is one of the costs of the business, and an attempt is made to allocate it to those whose traffic contributes most to it, viz., the business users.

Chart 5 shows the average daily originating traffic in the city of Rochester over a period of nine years. You will note that the traffic shows a steady and consistent increase from an approximate average of 220,000 calls per day in 1922 to nearly 425,000 in 1930. You will note how consistently the curve dips in midsummer of every year. Observe also how June of 1930 held up as compared with other years.

Classification of Originating Calls

The following table shows the class of originating calls, the number and per cent each is of the total and the number of operators required in handling a call of each type:

Type of Calls	No. of Calls	% of Total	No. Ops. Req. to Handle
A. B. toll...	1,550	.4	3
Long distance	3,775	.9	4 or more
Information..	5,390	1.2	2
Intercepting..	9,215	2.1	2 and 3
Local multiple	117,583	28.0	1
Trunked	284,750	67.4	2
Total or average	422,263	100.0	1.7

It will be noted that the srevices of an average of 1.7 operators are required in the handling of every call originating in Rochester.

A-B toll service is about three times as fast on the average, and 20 per cent cheaper, than long distance service, for the subscriber when he can talk with anyone answering at the called station.

Where it is necessary to talk to a particular person at a distant number, it is cheaper and faster for the calling subscriber to place his call, specifying the person with whom he wishes to talk, unless he is sure that his party will be handy to the telephone, when a station-to-station call will prove faster and cheaper.

A-B toll service is available to Rochester Telephone corporation subscribers to 25 towns (listed on page seven of the telephone directory) immediately surrounding Rochester and to Buffalo. These calls can be made with the same ease as calls from one exchange in the city to another and with almost the same speed.

The number of A-B toll calls has increased from 750 a day to an average of 1,550 calls a day, an increase of 100 per cent in six months from July 1, 1930, when this class of service was adopted, to January 1, 1931.

Of the 5,390 calls per day handled at the information desk, 50 per cent are for numbers listed in the book. From three to five extra operators are required at this desk by reason of the failure of subscribers to use the directory. Information traffic fluctuates from 3,600 calls a day just following a directory issue to 6,000 calls just previous to a directory issue.

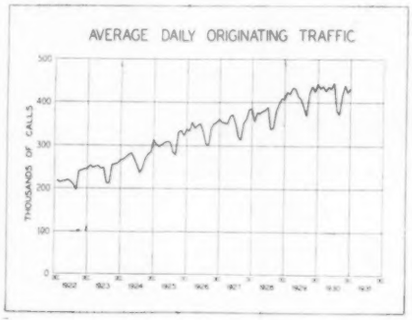


Chart No. 5

At the intercepting desks in the city of Rochester 8,215 calls a day are handled. Of these 8,215 calls only 20 per cent, or 1,642 calls, should properly go there. Of the remaining 80 per cent (or 6,573 calls) 65 per cent (or 4,272 calls) reach there by reason of subscribers' errors, and 35 percent (or 2,301 calls) by reason of errors of the operator. In the language of the postal department, 80 per cent of these calls go to our "dead letter office."

Calling numbers from memory, omitting letters on party lines, putting letters on individual lines and transposing of numbers account for the errors of the subscribers. Transposing of numbers, misplugging for interoffice trunks and taking of doubtful numbers account for the operators' errors.

Of all the calls reaching the intercepting desk in error, about 50 per cent are handled without further inconvenience to the subscriber than again asking what number he is calling, the correct number being then ordered up by the intercepting operator.

Nature of Customer Complaints

An average of 1,067 complaints per month was received during 1930 or an average of 41 complaints per day. The classification and number of complaints of each class is shown for the average day, as follows:

Nature of Complaints	No. of Complaints per Day
Party line trouble.....	13.8
Called in error.....	9.6
Slow answers	5.3
Cut-off	3.8
Don't answer	3.2
Miscellaneous	3.2
Equipment	1.6
3rd party connected.....	.5
Total	41.0

While this number of daily complaints seems large at first glance, yet 41 complaints out of 422,000 calls handled is only .9 of one complaint for every 10,000 calls, or 9 complaints for every 100,000 calls.

Party line troubles rank first in number of complaints and are occasioned almost entirely by a few subscribers to this service who hold long conversations or neglect to replace the receiver after conversation, thus not only affecting themselves but other subscribers as well.

The next item of complaint, in point of numbers, is that of called in error. These complaints are occasioned almost entirely by subscribers, as follows: Calling numbers from memory; transposing of digits; associating exchange names with localities or with nearby thoroughfares.

Of the total complaints "called in error" received in a month, we have found by observation and check that only 15 per cent of them are mistakes of the operator and that 85 per cent are mistakes of the subscriber.

Slow answers, the third item of complaint in point of numbers, must be the fault only of the telephone corporation, and is principally occasioned by the inability of the operating force to give a rapid answering service during occasional surges of traffic.

Fourth in point of numbers in the list of complaints is cut-offs. Five per cent are occasioned by failure of the equipment, 15 per cent by the operators, 35 per cent by the calling subscriber, and 45 per cent by the called subscriber.

Asks Consideration for Operator

Here is a thought I should like to leave with you: At some time or another each of you receive a letter with your address thereon, but intended for someone else. Surely this is not the fault of the mail carrier and it would never occur

(*Continued on page* 54.)

FORT DEARBORN HOTEL

Announces

SENSATIONAL REDUCTIONS

$1.50 A DAY
More than 250 rooms with private toilet at this rate

SPECIAL WEEK-END (*Saturday & Sunday*) RATES

250 rooms with private toilet for double occupancy per person... $1.00 A DAY

250 rooms with private bath for double occupancy per person... $1.50 A DAY

LA SALLE & VAN BUREN STREETS

CHICAGO

OPPOSITE LA SALLE STREET STATION

BOND
REG. U.S. PAT. OFF.

INDUSTRIALITE

Thousands upon thousands of these flashlights have already been purchased on special orders by many of the largest railroads and industrial concerns in the country, which have selected Bond Industrialites because of their proven superiority. This light is exceptionally well built, easily operated and will give maximum service to the user.

It has a tough fibre case, which can be subjected to the roughest usage without danger of being marred, scratched, dented or having the efficiency of the light impaired in any way whatsoever. A strong metal clip makes it possible to attach the Industrialite to the belt, pocket or other convenient places. A hole drilled in the clip is provided so that the light may be hung from a nail or peg. It is equipped with standard batteries and bulbs, which are procurable anywhere.

BOND ELECTRIC CORPORATION
JERSEY CITY, N. J.
CHICAGO SAN FRANCISCO

HOTEL HARRISON

CHICAGO'S NEWEST DOWNTOWN HOTEL

RUNNING ICE WATER IN EVERY ROOM
$2.50 AND $3.00 WITH BATH
NO HIGHER

RADIO IN EVERY ROOM

NO PARKING WORRIES
DIRECT ENTRANCE FROM HOTEL TO HARRISON PARKING GARAGE

HARRISON STREET JUST OFF MICHIGAN BOULEVARD

CHICAGO

With Manufacturers and Jobbers

INDIANAPOLIS CO. DESIGNS IMPROVED TELEPHONE BOOTHS

A new telephone booth, artistically designed as well as soundproof, which is expected to help telephone selling, has just been placed on the market by the Allen A. Wilkinson Lumber company of Indianapolis, Ind.

Besides the sound insulating it has been comprehensively designed with every attention to detail. It is distinctly advanced both in appearance and construction, for which a patent has been applied. It is of knock-down design and easily erected.

A complete line of booths is offered, giving a selection of five different models. There are small models which will save space.

A door of exceptionally pleasing appearance with a full length mirror is offered in one of the models. Such an innovation should be welcomed in high grade places of business.

All are made from sound insulating material and synthetic wood. The materials are selected for their durability and heat and moisture resisting qualities. These booths are designed for either wall type or desk telephone.

Simplicity of assembly and sturdiness is accomplished by bolting with strong corner angles and bolts. No wood screws are used.

Dull brass spring hinges are also bolted on door and side of partition. These hinges are especially appreciated in a busy place where the personnel has little time to close booth doors after customers. There are no latches to turn as cartridge type catches are used in connection with dull brass door pulls.

Ventilation is by space under the door and an opening in the ceiling. All booths are equipped with electric light and shelf. They also can be ordered equipped with electric fan and door operated light switch for a small additional cost.

A unique feature is a glass plate nonmutilating guard in the pencil-scratching, knife-cutting area.

These booths are furnished in attractive panel effects and finishes to harmonize with all interiors.

ORDERS STROMBERG BOARD

The Central West Public Service company, Omaha, Neb., has purchased a two position junior multiple switchboard from the Stromberg-Carlson Telephone Manufacturing company. The board will be installed at Madison, Minn. It will be equipped with 400 central energy and 30 toll and rural lines and with complete terminal, power and machine equipment.

DIVERTER POLE GENERATOR FURNISHES UNIFORM FLOATING CHARGE

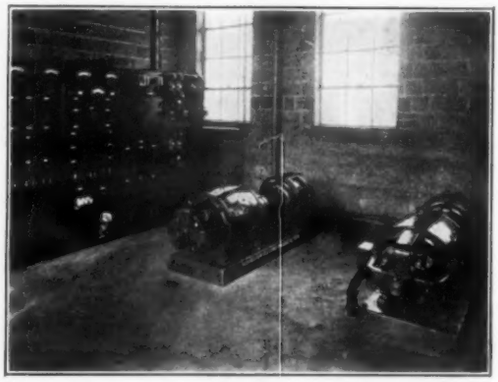
The diverter pole generator is an economical method of charging storage batteries by the floating method, and possesses the five following characteristics:

1. It is stable in operation with the very small current output normally required to carry the load and keep the battery fully charged at all times.

2. It automatically transfers to the battery any current demands beyond the normal capacity of the generator.

3. It automatically returns to its original voltage when the load drops back to normal.

4. It is capable of delivering its rated current capacity at a sufficiently high voltage to accomplish a quick recharge of the battery following any prolonged power interruption as well as for an occasional over-charge of the battery.



Diverter pole generator manufactured by The Electric Products Company of Cleveland.

5. It is free from any characteristics of "running away" or reversal of polarity in case of power interruption.

A diverter pole generator might be described as a shunt interpole machine. At no load, a part of the magnetic flux resulting from the shunt coil on the main pole piece is diverted and does not pass through the armature.

As the load increases, the series winding on the diverter pole rediverts this flux to the armature and provides a commutating field. A diverter pole generator actually carries the entire exchange load when floating with a storage battery.

A telephone exchange operated in this manner showed the following current requirements for a 24 hour period:

The entire exchange load was carried by the generator from 3 p. m. to 11 p. m. Similarly from 3 p. m. to 11 p. m. the battery charge was but a trickle, just sufficient to compensate for internal losses, prevent sulphation and maintain gravity.

From 11 p. m. to 6 a. m. the generator was shut down and the battery carried the load over the hours of low demand. From 6 a. m. to 8 a. m. the generator restored to the battery practically all the energy discharged during the night. This short period gives no opportunity for battery sulphation. The generator, during these two hours of maximum battery demand, also carries the entire exchange load.

From 8 a. m. to 3 p. m. conditions duplicate those of from 3 p. m. to 11 p. m.

If conditions arose where the total load exceeded the safe capacity of the generator its voltage would drop inherently and the battery would carry any dangerous over-load as long as it lasted.

The diverter pole generator is manufactured by The Electric Products Company of Cleveland, Ohio, and complete information can be had by writing direct to that concern.

WARREN HEIM NOW WITH ST. LOUIS CONCERN

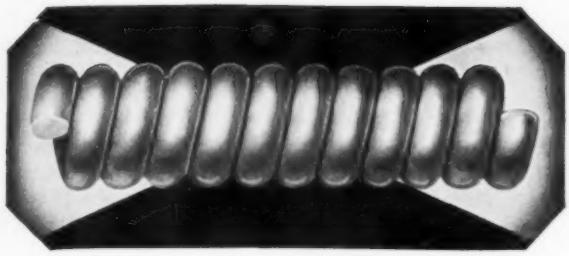
Warren M. Heim has been associated with the New York office of the James R. Kearney corporation of St. Louis, Mo., for the past six months.

Mr. Heim needs very little introduction to the electrical industry because of his past connections with utility manufacturing concerns.

Warren M. Heim, who is now connected with James R. Kearney Corp.

Mr. Heim was graduated from Pennsylvania State College in 1910 with a

(*Continued on page* 54.)



Galvanized Telephone Wire and Steel Strand

Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating....That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

Look for the **Crapo** Seal!

Indiana Steel & Wire Co.
Muncie, Indiana

Crapo GALVANIZED PRODUCTS

Carry An Accurate Pocket Ohmmeter For Circuit Testing Of All Kinds

JEWELL

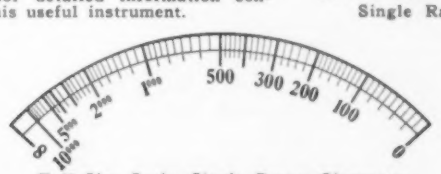
The Jewell Pattern 89 Ohmmeter provides a simple means for quickly and accurately checking or making resistance measurements on all outside lines and central office circuits.

It is completely self-contained, very light in weight, and is easily carried in a pocket. A standard 1½ volt flashlight cell within the case provides the necessary potential. Accurate measurements are assured by a simple screw adjustment that compensates completely for any change in battery voltage.

The Jewell Pattern 89 Ohmmeter is available in single and double range models, with ranges expressly designed for telephone testing.

Write for detailed information concerning this useful instrument.

Pattern 89 Ohmmeter Single Range



Full Size Scale, Single Range Ohmmeter

Jewell Electrical Instrument Company
1650 Walnut Street, Chicago, Illinois

SERVING CANADA . . .

With a Complete Stock of Telephones, Dial and Manual Switchboard Equipment, Construction Materials and Supplies

We are prepared to furnish telephone organizations throughout Canada with any item of telephone equipment—from the smallest article up to complete installations of metropolitan telephone systems. The products which we distribute are so well known that no detailed description of their high quality is necessary. In addition to this most complete line, we have our own manufacturing and repair facilities—each department is under the supervision of an expert. Consult us before making your next purchase—prices and proposals gladly furnished upon request.

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VANCOUVER, B. C.

Representatives in Canada for

AMERICAN ELECTRIC COMPANY INC., Chicago
AUTOMATIC ELECTRIC INC., Chicago
AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Liverpool
THE AUTOMATIC ELECTRIC COMPANY, LIMITED, Chicago
ALTON BATTERY COMPANY, Alton, Eng.

Telephone Activities Abroad

Dispatches from Foreign Countries Keep United States Telephone Men Informed Concerning Telephony of the World.

Annual Report of Anglo-Portuguese Telephone Company

Gross profits were shown to stand at 84,195 pounds for 1930 as compared with 71,287 pounds for 1929, at the forty-fourth general meeting of the Anglo-Portuguese Telephone Company, Ltd., held in London recently. Net profits showed an increase of 18 per cent over the previous year.

England Establishes Telephone Service with Indo-China

The Postmaster General has announced that a public service is now available between England and the following places in French Indo-China, namely, Saigon and Cholon and Pnom-Penh.

Possible Telephone Equipment Market in Northern Morocco

Spanish and French authorities in Morocco have recently taken steps to improve telephonic and telegraphic communications between their respective zones by connecting a number of places with telegraph circuits, including Rabat with Tangier, Rabat with Ceuta and Tetuan by way of Larache; and Nador with Berkane.

The French Zone of Morocco and Tangier, as well as the cities in Spanish Morocco other than Ceuta, are at present isolated from Europe telephonically and the construction of the above mentioned circuits would supply a much needed connection between Tangier and the cities of the French Zone with the European system via Ceuta, which latter place is already connected with Spain by means of a submarine telephone cable, under the Straits of Gibraltar, owned by the National Spanish Telephone company.

Telephone System of Palestine

The telephone system for private use was introduced into Palestine in 1921, and is owned and controlled throughout Palestine and Transjordan by their respective Governments, as are also the telephone communications in railway stations. The system is manual, and has about 3,000 subscribers.

Buenos Aires Important International Communications Center

Radio telephone service between Australia and Argentina, Uruguay and Chile, was opened recently using the radiotelephone circuit which the International Telephone and Telegraph corporation operates, in conjunction with the British Post Office at Rugby and the Amalgamated Wireless company at Sydney, Australia. In Buenos Aires this circuit will connect with the lines of the United River Plate Telephone company, which operates the most extensive telephone system throughout the Argentine, and also connection will be made with the modern international telephone circuits which run under the River Plate to Uruguay and across the Pampa and over the Andes Mountains to Chile, this last forming the highest international telephone line in the world.

New Automatic Telephone Station in Stockholm

Sweden's largest automatic telephone station, having a capacity of 40,000 lines, has been installed in Stockholm. Stockholm already has two automatic stations, one for 20,000 lines and another for 15,000 lines, and has more telephones per capita than any other large city in Europe and also New York and Chicago.

Telephone Service Between Italy and Sardinia

While direct telephone service between Italy and Sardinia is actually an accomplished fact, the service is still in an experimental stage. The telephone service between Italy and Sardinia is classed as interurban, and its control therefore comes under the Ministry of Communications. Zone 4 of the Italian Telephone System includes Sardinia, where the telephone service of the island is carried on by the Societa Telefonica Tirrena, but, that service does not include the system which links the mainland with the island.

Progress of Construction of Greece Telephone System

Under the concession granted on February 8, 1930 to the German firm of Siemens Halske of Berlin for the construction, maintenance and exploitation of a telephone system in Greece for a period of 38 years, progress has been unexpectedly slow and as a result there has been question of finding the concessionary.

Subscribers Decrease in Guadalajara, Mexico

The Ericsson Telephone company, a Norwegian owned corporation, seems to be showing a decrease in the number of its Mexican subscribers. From figures obtained it appears that their total number of subscribers for the city of Guadalajara has dropped from about 1,400 at the end of 1929 to around 900 at the end of 1930. While in some cases these have been lost to their competitor, in most cases the decrease has been caused by people formerly having both services canceling their contract with this company and retaining the phone of the Mexican Telephone company because of the wider service offered.

La Paz Plans to Install Automatic Telephone System

The Municipality of La Paz has called for bids for the installation and operation of an automatic telephone system.

Hawaii to Have Inter-Island Telephone System

The Mutual Telephone company has begun the actual construction of the inter-island radio telephone system on four of the Hawaiian islands and the installation of a new land telephone system on the island of Molokai.

First Conversations Between Egypt and the United States

The first radio-telephone conversation took place between Egypt and the United States last month. Calls were experimental and arranged through a special set-up connecting Shepheard's Hotel, Cairo, by land line with the S. S. Belgenland in Alexandria harbor. The Belgenland carried radio-telephonic apparatus by which connection with the United States was made.

Bombay Telephone Lines Not To Be Extended

There is little prospect of the extension of trunk lines in the province of Bombay in the near future, according to the Governor of Bombay, who has referred particularly to the matter and stated that although the trunk telephone line from Bombay to Poona and Sholapur had been in existence since 1924, and although the Government had given a guarantee for the time being of a certain amount in aid of it, the lack of support from its public indicated that there was not a very keen demand for trunk telephone connections in India.

The Bombay Telephone company made a net profit of about $500,000 during the year 1930. The revenue of the company was much affected by the trade depression prevailing in the country, but the falling tendency of the revenue has been arrested, and a better result is expected.

News From the Field

Plans have been completed and work will begin soon on a new telephone exchange building in Joliet, Ill., for the Illinois Bell Telephone company. The structure will be three stories, of fireproof construction, and the cost is estimated at $300,000.

The Easton telephone exchange, Allentown, Pa., celebrated its fifty-first birthday on May 1. The exchange began with 25 wires which were intended to serve that number of subscribers. It was the first exchange in the city which now has three exchanges.

The executive committee of the Hyannis Telephone company, Hyannis, Mass., has authorized an expenditure of $13,495 for additional equipment to improve service of the Hyannis exchange. The sum will be spent chiefly for enlarging the switchboard and providing for more operators.

The new telephone plant in Benton Harbor, Mich., erected by the Michigan Bell Telephone company at a total cost of near to a million dollars, was formally opened and dedicated with impressive ceremonies on May 2.

The Scotia Telephone company has recently completed and cut into service two new copper metallic circuits between Eldon and Versailles, Mo. This was done to meet increased business due to the $30,000,000 dam project at Bagnell, Mo., and the growth of lake resorts due to the formation of the new Lake of the Ozarks with its 1,500 mile shore line.

Telephone toll charges for calls between Richmond, Va., and Fairfield, Va., have been eliminated by the Chesapeake and Potomac Telephone company and a new exchange called Eastern has been established which has direct communication with both Richmond and Fairfield.

It is understood that the New York Telephone company, which for the last decade has obtained additional funds from its parent company, the American Telephone and Telegraph company, will appear in the market shortly with an issue of around $75,000,000 bonds. As of December 31, 1930, the total bonds outstanding was $145,029,403, represented by two issues of 6s and one issue of 4½s.

A crew is laying 7,000 feet of cable underground within the city limits of Armour, S. D. When this work is completed the entire city system of the Armour Telephone company will be underground.

The L. M. Ericsson Telephone company, controlled by the Kreuger & Toll company reports a net profit of $1,922,000 for 1930 against $1,905,000 in 1929. Together with profits carried forward from the previous year, the total sum at the disposal of the next stockholders' meeting is $2,345,000.

The appointment of Charles A. Robinson as general manager of the Chesapeake and Potomac Telephone company of West Virginia, succeeding V. B. Fitzpatrick, who goes to the Chesapeake and Potomac Telephone company of Virginia, has just been announced by Lloyd B. Wilson, president.

Work on the new quarters for offices and exchange of the Southwestern Telephone company at Wetumka, Okla., is nearing completion. Equipment for the common battery system will begin soon.

A new switchboard, containing 640 city stations and 80 rural lines is being installed in the new building of the Citizens' Mutual Telephone company in Bloomfield, Iowa.

A new switchboard has been installed by the Southern Indiana Telephone company at Guilford, Ind., and lines within the village of Guilford have been completely rebuilt and are now carried into the new telephone office through underground cables.

The Mountain States Telephone and Telegraph company is adding some important switchboard equipment facilities, due to the continuous growth of the Greeley office, including 1 additional section, 3 positions, No. 1 common battery switchboard; 200 additional multiple lines; 340 additional answering jacks; 100 additional toll line multiple jacks; 10 bays of relay racks, and the conversion of the two local operating positions to long distance positions.

Eight new telephone central offices will be introduced in New York City soon and three more in the late summer. Each will be given the name of an existing office in its general neighborhood but with different numerals.

Investigate Our Centralized Accounting Plan

This monthly Audit will save you lots of money and give you important information that you should have about your business—the best of all business, if properly managed.

BOWDLE ACCOUNTING SYSTEM
CERRO GORDO ILLINOIS

PROTECT YOUR CABLE WITH EVERPROTECT

Permits underground installation without conduit. Protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

Ask your nearest Jobber for complete details.

NATIONAL CABLE COMPOUND CO., INC.
Mitchell - Indiana

To Reach the Man
Who Does the Buying
Advertise
in
TELEPHONE
ENGINEER

dependable
NORTHERN WHITE CEDAR POLES
that offer *utmost* in Quality and Value.
***Guaranteed* Butt Treatments**
MICHIGAN POLE & TIE CO.
NORTHERN AND WESTERN POLES
NEWBERRY, MICHIGAN
Reed City, Mich. YARDS St. Paul, Minn.

Identify your inquiry to advertisers by saying—"As shown in TELEPHONE ENGINEER"

STROMBERG-CARLSON IN OAK HARBOR, MICHIGAN

(*Continued from page* 44.)

find all line relays neatly arranged on a relay rack with easy access for maintenance. A power board is provided for the control of the battery and ringing circuits. On this is mounted a Weston voltmeter and ammeter of ample size so that scales can be read at a distance. The switches are of standard size and are well constructed with ground-in contacts to assure full contact surface. All switches and meters are mounted on Monson Main slate panels, free from metallic veins and substantially mounted on an iron frame.

A tungar rectifier provides means for charging the batteries. This is under control of an ampere hour meter, which automatically cuts the rectifier on or off at pre-determined limits, thus providing even regulation and longer life for batteries. In case of failure of the Tungar bulb an alarm is provided as an indication of failure.

When all the telephones are changed to central energy, thus eliminating the use of dry cells in each telephone, the annual saving on this one item will go a long way in offsetting the carrying charge of the investment in the new equipment.

The switchboard consists of three positions, with calculagraph panels between positions one and two for convenience in handling toll in addition to local business. The keyshelves are of the low type, providing a comfortable position for the operators by use of low operator chairs instead of the usual high type. All lines are arranged in multiple with line lamps associated with the multiple jacks with two appearances of the line lamp. This important feature makes each incoming call available to all operators and provides means whereby each operator can complete each call without the aid of additional operators or equipment. With this even distribution of operators' work it is possible to give fast, accurate service with the greatest economy of operation.

WITH MANUFACTURERS AND JOBBERS

(*Continued from page* 50.)

degree of B. S. in Electrical Engineering. Since that time he has been associated with E. L. Phillips & company of New York City as a construction engineer, and with W. N. Matthews & Brother of St. Louis, Mo., which position he held for eight years. Then he became district manager of Hubbard & company with offices in New York City, after which he was transferred to executive headquarters in Pittsburgh in the position of assistant manager.

Later he became manager of the line material department of the Oliver Iron & Steel corporation, after which he was appointed general sales manager of the entire company. In 1928 and 1929 Mr. Heim was associated with the Nuway Tool corporation in New York City as vice-president, after which he was connected with the Line Material company at South Milwaukee, Wis.

Mr. Heim's many friends will wish him well in this new enterprise.

REQUIREMENTS OF MODERN TELEPHONE TRAFFIC

(*Continued from page* 48.)

to you to place the blame on him. I am asking that the same consideration be given the telephone operator. When you are called to the telephone in error, ask the calling party what number they asked for. If they repeat your number, then you know the calling party is to blame and not the telephone operator. The mail man has no choice but to deliver the letter to the address designated; the telephone operator has no choice but to ring the number requested.

At the present time the United States Postal Department leads all national communication agencies with approximately twenty-six billion pieces of mail handled annually.

We will sell your
Telephone Directory ADVERTISING
or will publish your directory complete
L. M. BERRY & CO. DAYTON, OHIO

Send for free sample and prices on
UNIVERSAL DROP WIRE INSULATORS
Universal Specialty Company
711 Poplar St., Terre Haute, Ind.

KELLOGG Magneto Desk Stands and Signalling Sets

$10.00

Latest desk stands, black finish, ring felt bottoms, No. 41 slip receivers, bakelite shell, with oak signalling sets No. F2328, 3 bar 1000. Just like new. Prompt shipment.

Send for Our July Price List

TELEPHONE REPAIR SHOP
ROGERS PARK STATION CHICAGO

RECONSTRUCTED EQUIPMENT

Kellogg No. 2531 inside connection 4-bar 1600 ohm Bdg. compacts with push button, Alternating and pulsating current Gen. and Condenser. Wired secret call to Central on Grounded lines @	$ 9.00
Kellogg No. 2696 type 4-bar 1000 or 1600 ohm Bdg. compacts @	8.25
Western Elec. No. 317 inside connection 3-bar 1000- or 1600 ohm Bdg. compacts @	8.25
Kellogg No. 28 Unbreakable type desk set with W. E. No. 315 inside connection 3-bar 1000 or 1600 ohm signal sets @	10.00
Western Elec. No. 315 inside connection 3-bar 1000-1600 or 2500 ohm desk set signal sets @	5.35
Western Elec. No. 240 External post connection 3-bar 1000-1600 or 2500 ohm Bdg. hotel set @	5.00
Dean Elec. No. 240 4-bar 1000 or 1600 ohm Bdg. compacts @	6.75
Chicago Tel. Supply Co. 4-bar 1000 or 1600 ohm Bdg. compacts @ $6.75—5-bar @	7.50
Leich Elec. desk set complete with Stromberg 4-bar 1000-1600 or 2500 inside cord connection signal set @	8.75
Western Elec. No. 329 or 323 Transmitters with backs and Mouthpiece @	1.25
Automatic Elec. Receivers with repolished shell and new Cord @	1.00
Leich Elec. No. 7a Ringing machine, operates off 110 volts A. C. Light Ckt. @	20.00
Western Elec. No. 122 External post Receivers less cord @	.65

Write for Bulletins
REBUILT ELECTRIC EQUIPMENT CO.
1940 West 21st Str., Pilsen Station
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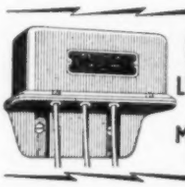
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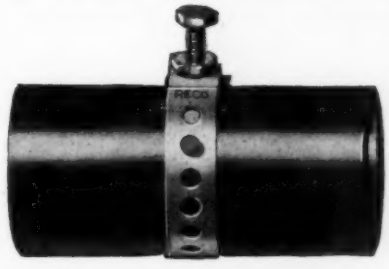

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